Site: SLAAP
ID# MO4210021222
Break: 3.0
Other: N/D

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LIST OF ABBREVIATIONS, ACRONYMS, AND TERMS

ACM	Asbestos Containing Material
AMCCOM	U.S. Army Armament, Munitions, and Chemical Command
AMCOM	U.S. Army Aviation and Missile Command
ASTM	American Society for Testing and Materials
ATCOM	U.S. Army Aviation and Troop Command
AVSCOM	U.S. Army Aviation Systems Command
bgs	below ground surface
BRA	Baseline Risk Assessment
CALM	Cleanup Levels for Missouri
CCTV	Closed Circuit Television
CENWK	Kansas City District, USACE
CEWES	U.S. Army Corps of Engineers, Omaha Laboratory
COC	Chain-of-Custody
COE	Corps of Engineers
CQAB	Chemistry Quality Assurance Branch, USACE
CQC	Chemical Quality Control
DCQCRs	Daily Chemical Quality Control Reports
DoD	Department of Defense
DQOs	Data Quality Objectives
EBS	Environmental Baseline Survey
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
FOST	Finding of Suitability to Transfer
FSP	Field Sampling Plan
gpm	gallons per minute
IAG	Interagency Agreement
IDW	Investigation Derived Waste
LBP	Lead Based Paint
LIMS	Laboratory Information Management System
MDLs	Method Detection Limits
MDNR	Missouri Department of Natural Resources
NON	Notice of Noncompliance
NRD	Natural Resources District
PCB	Polychlorinated Biphenyl
PFE	Plant Facilities and Engineering, Inc.
PPE	Personal Protective Equipment
PRG's	Preliminary Remediation Goals
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SEMCOR	Titan Systems Corporation, SEMCOR Division
SHERP	Safety, Health, and Emergency Response Plan
SLAAP	St. Louis Army Ammunition Plant

LIST OF ABBREVIATIONS, ACRONYMS, AND TERMS

SLOP	St. Louis Ordinance Plant
SMPRO	Site Manager Pro®
SSEBS	Site-Specific Environmental Baseline Survey
SVOCs	Semi-volatile Organic Compounds
TTEMI	Tetra Tech EM, Inc.
USGS	U.S. Geological Survey
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

1.1 BACKGROUND

The purpose of this Field Sampling Plan (FSP) is to establish the sampling strategy, sample locations, and the procedures and protocols to be followed during implementation of site-specific environmental baseline survey (SSEBS) at the St. Louis Army Ammunition Plant (SLAAP) located at 4800 Goodfellow Boulevard in St. Louis, Missouri. This document was prepared on behalf of the U. S. Army Corps of Engineers (USACE), Kansas City District and the U.S. Army Aviation and Missile Command (AMCOM), Huntsville, Alabama under URS Contract number DACW41-96-D-8014, Task Order 0019.

This Field Sampling Plan (FSP) constitutes Part I of the Sampling and Analysis Plan (SAP). Part II of the SAP is the Quality Assurance Project Plan (QAPP). This FSP is organized into eleven sections and the contents of each section are discussed below. References are made to figures from the comprehensive EBS report completed by Tetra Tech EM, Inc. (TTEMI, 2000). The referenced figures from the comprehensive EBS are included in Appendix A.

- Section 1.0 – Introduction
  - Presents an introduction to the SAP and this FSP, including site history, environmental setting, an overview of site operations and process knowledge, and a summary of the comprehensive EBS.

- Section 2.0 – Project Organization and Responsibilities
  - Identifies organizations, roles, and responsibilities for key personnel to be used during the field activities.

- Section 3.0 – Sampling Program Rationale
  - Presents a sampling strategy based on the data quality objective (DQO) process.

- Section 4.0 – Field Activities
  - This section presents a description of the field activities, the rationale for conducting the activities, the field protocols to be used during the activities, and laboratory analysis for the planned sampling activities.

- Section 5.0 – Sample Chain-of-Custody/Documentation
  - Presents details regarding sample documentation including field logbooks, sample labels, sample collection field sheets and chain-of-custody.

- Section 6.0 – Sample Packing and Shipping
  - Presents details regarding sample packaging, shipping and archiving.

- Section 7.0 – Investigation Derived Waste
  - Presents details regarding handling, storage, and disposal of investigation derived waste.

- Section 8.0 – Daily Chemical Quality Control Reports (DCQCR)
  - Presents details regarding quality control reports.

- Section 9.0 – Corrective Actions
  - Presents a discussion of corrective actions for non-conformances identified in the field.

- Section 10.0 – Project Schedule
  - Presents a schedule for the field activities and reporting associated with this FSP.

- Section 11.0 – References
  - Presents references that are relevant to the basis of this FSP.

1.2 SITE HISTORY

The St. Louis Ordnance Plant (SLOP) was constructed in 1941. SLOP was a 276-acre, small arms ordnance plant that produced 0.30- and 0.50-caliber munitions. In 1944, 21.05 acres in the northeast portion of SLOP were converted from small arms munition production to 105-millimeter (mm) Howitzer shell production and this portion was designated as SLAAP. Additional land was acquired on the north side of SLOP (see **Appendix A, Figure 6-1**). Currently, the SLAAP property contains eight unoccupied buildings that were used to house SLAAP's main operating processes.

After World War II, SLAAP was placed on standby status. It was reactivated from November 1951 to December 1954 and again from November 1966 to December 1969 to support 105-mm Howitzer shell production. The plant was maintained and operated by the Chevrolet Shell Division of General Motors from 1951 until 1958, by the U.S. Defense Corporation from 1958 to 1966, and by the Chevrolet Motor Division of General Motors from 1966 until 1972, when Donovan Construction Company was awarded the maintenance and surveillance contract.

In 1984, buildings at SLAAP were renovated to house filing and administrative operations by more than 500 personnel from the U.S. Army Aviation Systems Command (AVSCOM). From 1986 to 1990, SLAAP was under the command of the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM). In 1989, the Department of the Army determined that SLAAP was no longer required to support its munitions mission, and most industrial equipment was removed from the plant. In 1990, plant ownership and control were placed under the U.S. Army Aviation and Troop Command (ATCOM). As of 1993, SLAAP maintenance and surveillance activities were being subcontracted by Donovan Construction Company to Plant Facilities and Engineering, Inc. (PFE). Since 1998, SLAAP has been vacant and under the control of AMCOM.

1.3 ENVIRONMENTAL SETTING

This subsection summarizes the topography, regional geology, hydrogeology, endangered species, archeology, and wetlands associated with the SLAAP property.

1.3.1 Topography

SLAAP is located in the southern portion of the Dissected Till Plains Section of the Central Lowland Province. The topography of this area consists of rolling uplands with slopes of 2 to 5 percent, and elevations range up to 550 feet above mean sea level. The elevation range within a 2-mile radius of the SLAAP property varies between 500 and 550 feet above mean sea level (msl), with the general topography sloping gently to the south (EDR, 1999). As reported in the *Installation Assessment of St. Louis Army Ammunition Plant,* the SLAAP property is bounded on the north by Interstate 70, on the west by Goodfellow Boulevard, on the south by PURO Chemical Division (PURO) (located in a portion of the former SLOP site), and on the east by Riverview Boulevard (USATHMA, 1979).

1.3.2 Regional Geology

The geology of the SLAAP property includes surficial deposits consisting of windblown silts and clays known as loess. The loess was derived from the Missouri River flood plain during the Pleistocene Epoch about 2 million years ago. The loess is overlain by a layer of clay and silty clay alluvium (USAEHA, 1993). Based on soil borings drilled to investigate underground storage tanks (UST) and other borings completed during the comprehensive EBS, the alluvium layer is 20 to 25 feet thick and the loess layer is 40 to 45 feet thick (USAEHA, 1993) (TTEMI, 2000). Loess deposits are present to about 25 feet below ground surface (bgs), and silty clays and clays are present to about 20 feet bgs at the SLAAP property (USATHMA, 1979) (TTEMI, 2000). Except for approximately 3 acres, most of the SLAAP property is covered by asphalt or buildings.

Bedrock in the area consists of flat-lying sedimentary formations made up mostly of limestone and dolomite. A slight, regional northeast dip has been modified by several minor folds or flexures that trend northwest to southeast. A soil test boring drilled in 1971 at the SLAAP property revealed that medium-hard, light gray, medium- to fine-grained limestone is present at 64.9 feet bgs. This formation is St. Genevieve limestone of Mississippian age and is overlain by 42.6 feet of medium-hard, light yellow to gray, sandy clay shale of lower Pennsylvanian age (USATHMA, 1979).

1.3.3 Hydrogeology

Bedrock units in and around St. Louis are capable of yielding varying amounts of groundwater. Well yield depends on site-specific geologic and well characteristics. Most wells in the St. Louis area yield a maximum of 50 gallons per minute from depths down to 800 feet bgs (USATHMA, 1979). These wells are screened in limestones and sandstones ranging in age from Mississippian to Ordovician. Water yields of up to 1,955 gallons per minute (gpm) can be expected from wells drilled in thick alluvial deposits that contain little silt or clay-like material. However, no potable water wells are reported to exist within 3 miles down gradient of SLAAP (USAEHA, 1993).

what about comments on the EPS to the contrary?

Regional groundwater flow in the SLAAP area is north-northeast toward the Mississippi River. The runoff in St. Louis County discharges to the Missouri River to the north, the Mississippi River to the east, and the Meramec River to the south. No surface water is present on the SLAAP property. Storm water on the property is collected by catch basins that discharge to the Metropolitan St. Louis Sewer District combined sewer system.

1.3.4 Endangered Species

Except for small grassy areas, the SLAAP property is covered by buildings and asphalt. The closest body of water, the Mississippi River, is located about 3 miles from the property. No endangered or threatened species have been identified on the property. According to the

Missouri Department of Conservation, the transfer, outgrant, or disposal of the SLAAP property will not impact any endangered species or cause sensitive environment concerns in the vicinity of the property (Missouri Department of Conservation, 1993).

1.3.5 Archeology

SLAAP is located across the Mississippi River from the American Bottoms archeological region. In 1985, an archeological overview and management plan was prepared for SLAAP. According to the plan, no known or identifiable potential archeological sites are located on the SLAAP property. Most of the SLAAP property is asphalt-paved or covered by structures; therefore, much of it has been impacted by some type of ground disturbance. It is doubtful that any surficial archeological sites remain on the SLAAP property. However, the existence of subsurface archeological deposits is possible (Woodward-Clyde Consultants, 1985).

A letter from MDNRs Division of State Parks dated June 21, 1994 indicates that none of the SLAAP structures are eligible for inclusion on the National Registry of Historic Places (MDNR, 1994).

1.3.6 Wetlands

A 1994 National Wetlands Inventory map of the area within 2 miles of SLAAP was reviewed to identify surface water bodies and wetlands. According to the map, the closest wetland is approximately 1.4 miles east of SLAAP, and another wetland lies approximately 1.5 miles northwest of SLAAP. No wetlands were identified on the SLAAP property or in its immediate vicinity (EDR, 1999).

1.4 OVERVIEW OF SITE OPERATIONS AND PROCESS KNOWLEDGE

This section presents an overview of the manufacturing activities conducted at the site, as reported in the comprehensive EBS report (TTEMI, 2000). Since construction of the facility in 1941, SLAAP has supported two primary production missions. First, several of the SLAAP buildings were utilized in support of 0.30-caliber munition production as part of SLOP operations from 1941 through 1944. Second, SLAAP was utilized to produce 105-mm Howitzer shells during intermittent operation phases from 1944 through 1969. Accordingly, an overview of each of the production missions is presented in the following subsections with respect to general site layout, summary of the product processes, and building descriptions. **Tables 1-1** through **1-11** provide a summary of the operational information with respect to both production missions for each of the SLAAP buildings.

1.4.1 Manufacturing Processes from 1941 to 1944

General Site Layout

not included with this

Appendix A, Figure 6-1 shows SLAAP's north property boundary when it was part of SLOP from 1941 through 1944. SLAAP's north boundary ended along the north side of the train tracks that served former Building 202 ABC (now Building 3). In the extreme northwest area, the property boundary extended approximately 280 feet north to accommodate a parking area measuring approximately 360 by 280 feet. Except for a guard house (Guard House 209 E), no buildings or manufacturing activities appeared to have occurred at areas north of the railroad train tracks that ran north of Building 3. Residential housing units were located to the north of the SLOP property.

The small arms ammunition (0.30-caliber) production unit was comprised of a 0.30-caliber production building (Building 3), a 0.30-caliber loading building (then referred to as Building 202D, now Building 5), a 0.30-caliber primer insert building (then referred to as Building 202E, now Building 6) and a powder canning building (then referred to as Building 202F and later converted to the acetylene production [Building 9], now demolished). Other buildings included the powder storage building (Building 202H, now demolished), oil storage buildings 202 J and 202 K (now demolished but originally located south of Buildings 5 and 6, respectively), Guard Houses 209 and 209 F, and Building 236 D. Guard House 209 was located on the northeast area of the property on Riverview Boulevard. Guard House 209 F was located at the northwest parking area entrance. Building 236 D was a fire equipment house, which is now attached to the SLAAP Compressor Building (Building 4).

Underground tunnels connect Building 6 to Building 3, Building 5 to Building 3, and Building 6 to the former SLOP Building 203, which is now part of the CONTICO Company. These underground tunnels were used to extend high-pressure steam, treated de-ionized water, and other utilities from SLOPs centralized service center to the SLAAP buildings.

Summary of the Production Process

The 0.30-caliber ammunition round consists of a brass cartridge case, a projectile, powder, and a primer. Manufacture of the cartridge case began with a brass cup. The cup was shaped through a series of cold forming operations, including drawing and other shaping processes. The brass was annealed (heated evenly while maintaining the heat level) at various times during the shaping process to eliminate metal stresses caused by the drawing operations. The brass was also pickled (treated with sulfuric acid) to remove metal oxides. Lastly, the brass was washed and dried to remove the sulfuric acid and associated moisture.

Procedures for fabricating the projectile were similar to those used to shape the cartridge case. Each projectile had a copper jacket shaped through a series of drawing and shaping processes similar to those employed during production of the cartridge case. A lead core (produced elsewhere) was inserted into the copper jacket (ball ammunition) in bullet assembly machines. Armor piercing rounds contained hardened steel cores instead of lead cores.

Smokeless powder and primer (both produced elsewhere) were added to complete the round. A primer such as lead styphnate, was added to the base of the cartridge case after the case was pierced and waterproofed with a varnish (shellac). This operation took place at what is now Building 6. A small quantity of smokeless powder was loaded into the cartridge case and the projectile was assembled and crimped. The loading, assembling, and crimping operations were conducted at what is now Building 5.

Appendix A, Figures 6-2 and **6-3** show the areas in Building 3 where specific 0.30-caliber ammunition manufacturing operations took place on the first and second floors, respectively. **Appendix A, Figure 6-4** shows the locations of manufacturing operations within Building 5 and

6. Each of these process areas, as well as those support processes conducted in Buildings 202 F, J, and K, are discussed in detail below.

Building 3, First Floor

For ease of reference, text discussing the layout of Building 3 will cite locations of alphanumeric building I-beams and columns as originally designated in record drawings as shown in **Appendix A, Figures 6-2** through **6-4**. This grid system designates the furthest north I-beam row as Row A. The I-beam number 1 is designated as the furthest west I-beam Row. Thus, I-beam B2 is the second I-beam from the north end of the building, and the second I-beam from the building's west wall.

Materials were received at the loading dock between I-beam Rows A and B and Rows 1 through Row 11, where a 3-ton hoist unloaded case cups, ball jackets, armor-piercing jacket coil stock and other raw materials. Raw materials were stored either in the southwest corner of the building between I-beam Rows H and L, and 2 and 5, or at the coil stock storage area between I-beam Rows 4 and 10, and C and G.

Coil reels were fed to either seven jacket blank and cup machines or to four base blank and cup machines located in the aisles between I-beam Rows 9 and 11, and C and H. Nine first-draw machines and 11 second-draw machines were installed in the aisles between I-beam Rows 11 and 13, and B and H. Twenty-eight bump machines were aligned in pairs between I-beam Rows 13 and 14, and B to H. A soap mixing room with two mixing systems was located in a room at I-beam Row 13 between I-beams A and B. The soap was used in pickling operations on the second floor. Fourteen third-draw machines and 10 first-trim machines were located along the aisle between I-beam Rows 14 and 15 from Rows B through H. Nineteen first-draw machines were located east of I-beam Row 15 between Rows B and H. Eighteen fourth-draw machines were located next to I-beam Row 16, nine on the east and nine on the west side of I-beam Row 16 between Rows B and H. Twenty-nine second-trim machines, nineteen on the west and ten on the east were located along I-beam Row 17 between I-beams B and H. Thirty pocketing machines were located along I-beam Row 18 between Rows B and H. The aisle between Rows 19 and 20 was occupied by 30 heading machines arranged in a similar fashion as the pocketing machines between I-beam Rows B and H.

A second loading dock was located between I-beam Rows 15 and 17 west of the electrical transformer vault between I-beam Rows A and B. Scrap salvage, including a baler system, was located in a room confined between I-beam Rows A and B and Rows 17 and 21.

Open corridors or aisles were maintained between I-beam Rows B and C and between I-beam Rows G and H throughout the first floor of Building 202 ABC. A maintenance area and a tool and machine shop were located west of the storage area between I-beam Rows 5 and 9 from I-beam Rows H to L.

Six Salem annealing furnaces, each equipped with independent turbo compressors, product elevators and quench tanks, were located between I-beam Rows 10 to 17 on the south side of the building. The product to be annealed was fed from the second floor through rectangular hoppers located on the north side of the furnace that connected directly to the annealing furnace drive system. The product was then quenched and transferred to the second floor by elevators located south of the furnaces.

South of I-beam Row K, between I-beam Rows 17 and 20, were 27 jacket trim machines, 23 for ball jackets and four for armor-piercing jackets. Twelve jacket first-draw machines, nine dedicated for ball jackets and three for armor-piercing jackets were located south of I-beam Row H between I-beam Rows 17 and 20. Twelve jacket second-draw machines were located north and south of I-beam Row J between Rows 17 and 20. Eighteen jacket third-draw and three jacket fourth-draw machines were located in the aisle between I-beam Rows J and K and Rows 17 through 20.

An air compressor room was located between I-beam Row 24 and 25 and A and B. Loading docks were located in the open bay between I-beam Rows A and B from Rows 26 to 32, and from I-beam Row 34 to the east end of the building.

Cup manufacture began in the bay between Rows 21 and 23 and C through G. Up to 47 head-turning machines (16 west of I-beam Row 22 and 31 in the aisle between I-beam Rows 22 and 23) were mounted on benches. Spiral chutes and elevators on the north and south ends transferred product between the first and second floors . Three vibrating feeders, fifteen body annealing furnaces, and an elevator were located just east of I-beam Row 23 from I-beam Rows C through G.

Twenty-nine taper and plug machines were located east and west of I-beam Row 24. These machines received product from two spiral chutes located next to I-beam C24 via feeders and belt conveyors. Product from the taper and plug machines was transferred to a belt conveyor located at floor level that discharged to the product elevator located near I-beam G24.

Twenty five finishing and trimming machines were located along I-beam Row 25. A spiral chute fed product from the second floor to a vibrating feeder. The vibrating feeder discharged to a feed belt conveyor that supplied the finishing and trimming machines. The product was then transferred to an elevator located on the north end just northwest of I-beam C25.

Mouth and neck annealing took place between I-beam Rows 25 to 27 and C through G. The aisle between I-beam Rows 25 and 26 and C through G housed one annealing laboratory. Twenty-four mouth and neck annealing machines were located in the bay between Rows 26 and 27. Casings were transferred from the second floor by a spiral chute and vibrating and rotary feeders to the mouth and neck annealing machines from the south end. The annealing machines discharged the casings to an elevator, rotary feeder and feed belt to the 30 final inspection machines located along I-beam Row 27. The casings were then transferred to the piercing machines by an elevator located at the south end of the final inspection machines southeast of I-beam G27.

Fifty bullet assembly machines, approximately thirty-six for ball bullets and fourteen for armor-piercing bullets, were located in the area between I-beam Rows 22 and 28 south of Row H to the south wall, leaving aisle space near the south building wall. The finished cartridge storage area was located between I-beam Rows B through G. through the east end of the buildings. An inspection area was located east of the bullet assembly area between I-beam Rows 28 to 33 south of Row H. A cafeteria with a kitchen and a men's locker room were located at the southeast corner.

Building 3, Second Floor

The west end housed a canteen area with a kitchen, storage room, fan room, and women's and men's locker rooms. The canteen was located between I-beam Rows B and G, and 1 and 8. The locker rooms were located south of I-beam Row G from Rows 1 through 9.

The same manufacturing operations described for the first floor were supported or performed on the second floor. Hoppers transferred cartridge case product from the second floor to the first floor and elevators conveyed product from the first floor to the second floor. The hoppers and elevator were located at the blank and cup, first-draw, second-draw, bump, third-draw, first-trim, fourth-draw, second-trim, and pocketing and heading machine lines from I-beam Rows 10 to 20, between I-beam Rows C and G. Similarly, the bullet jacket draw area included floor hoppers that conveyed bullet jackets to the first-draw, second-draw, third-draw and fourth-draw and jacket-trim areas. This area was located south of I-beam Row H between I-beam Rows 17 and 20.

Six 2,000-pound Salem picklers were located south of I-beam Row H between I-beam Rows 10 and 17. Each pickler was equipped with an independent pickling tank with vent system, acid rinse, cold-water rinse, hot-soap bath, hot-water rinse and dryer. Each pickler was placed within a drainage area with independent floor drains connected to the building sewer system. Six floor hoppers fed the Salem furnaces on the first floor. The hoppers were located north of I-beam Row J between I-beam Rows 10 and 17. Two product washers served by a common floor drain were located south of I-beams H10 and H11. Two more washers, each with a dedicated floor drain, were located along the north building wall south of I-beams B14 and B17. Two wash-and-dry machines were located in the cartridge draw area, each with independent floor drains. One machine was located between I-beams C13 and C14, and the other was located south of I-beams B18 and B19. Aisle space was maintained in the second floor of Building 202 ABC between I-beam Rows 20 and 21, at the north side of I-beam Row H, and along the south building wall.

what acid?
" conc?

Seven product washing machines and two drying machines were located between I-beam Rows 20 and 22. Two soap mixing machines and five wash barrels were also located in this area between I-beam Rows C and E. Four head-gauge shaker tables were located between the head turning and body annealing lines. A roller conveyor on the floor was used to transfer baskets used to feed the Lindberg furnaces located south of I-beams C25 and C26. Pickling and rinsing units, six wash barrels and two dryers were located in the bay between I-beam Rows 25 and 26 from Row D to just south of Row G.

Two fuel gas mixing systems were located in a room south of the north building wall between I-beam Rows 24 and 25. A washer was south of I-beams G24 and G25.

The hoppers that fed the 50 bullet assembly machines were located between I-beam 22 and 28, south of I-beam Row H though the south wall, leaving aisle space near the south building wall.

After final inspection, the cartridge cases were transferred to the Primer Insert Building (Building 6) by an overhead conveyor belt.

A 5-day cartridge storage area was located between I-beam Rows 29 and 34, and B and F. Four cartridge clip assembly units were housed between I-beam Rows 34 and 35, and between the north building wall and I-beam Row E. Forty-eight gauge and weight stations were located between I-beam Rows 28 to 37, and F and H. Five labeling and packing machines with a gravity roller conveyor and spiral chute to the first floor storage area were located between I-beam Rows

36 and 39 in the northeast corner of the building. Five Inman partition machines were located next to the east building wall between I-beam Rows F and H.

A loaded scrap salvage area was located between I-beam Rows 29 and 31 north of the south building wall. Primed cartridges inspection benches were located north of the south building wall between I-beam Rows 32 and 34. The inspection layout room was located along the south building wall between I-beam Rows 34 and 36. The southeast corner of the second floor was utilized as a women's restroom and locker room.

One overhead bridge connects Building 3 to Building 6 via the bridge between I-beam Rows 27 and 28. This bridge conveyed cartridge cases from the final inspection line for primer insertion.

Building 5

Appendix A, Figure 6-4 shows the former manufacturing areas from the first floors of Buildings 5 and 6. Five 0.30-caliber powder loading, assembly and crimping stations (four on the south side and one on the northeast side) were located in Building 5. This building did not have automatic loading machines. Four case shakers, one at each of the south stations, were used to supply cases for powder loading. Roller conveyors transferred cases from the case shakers to the powder loading compartment.

Four jacket shakers, one at each of the south stations, were used to supply ball or armor-piercing jackets for bullet assembly. A second conveyor system transferred loaded cases to just outside the independent assembly compartment, where the jacketed bullet was attached to the loaded cartridge case. The assembled bullet was crimped at one of the four independent crimping compartments. The cartridges were then identified in one of the four identifying units, inspected, and conveyed to the second floor of Building 3 for further processing.

It appears as if a station at the northeast corner of the building was a non-operational spare station. This station contained only powder loading, assembly, and crimping compartments and machines. No ancillary conveyor systems, tables, inspection benches, case and jacket shakers or identifying units were present. Other equipment on the second floor included the elevator and the conveyor system that brought the product from the first floor of Building 5 to the second floor of Building 3 to the gauge and weight area. No other equipment was installed on the second floor of Building 5.

Building 6

Appendix A, Figure 6-4 shows manufacturing areas in the first floor of Building 6 where ten primer invert machines and 36 primer insert machines were located. A laboratory equipped with service and primer drop test benches was located in the southeast corner of the building. Four of the primer invert machines were located in the middle section of the building, two along the south building wall and two along the north wall. The other six primer invert machines were located in the extreme southwest corner of the building, south of the locker rooms.

Thirty-six primer insert machines were located along the middle section of the building. Cartridge cases were fed from the overhead conveyor belt, into a spiral chute located on the second floor, and into a vibrating feeder located on the east side of the building. A feed belt that ran along the middle section of the building received the cartridge cases and transported them to the primer insert machines, which were arranged in pairs, one on each side of the feed belt.

Rectangular chutes transferred the cases to the primer insert machines. The primed cases were discharged to a belt conveyor that ran at floor level, and in turn, supplied an elevator located east of the spiral chute. Other than the conveyor system on the second floor, no equipment was installed on the second floor of Building 6.

Buildings 9 and 9A

Powder canning and storage took place at Buildings 9 and 9A, respectively. Powder containers (15-inch-diameter cylinders approximately 2.5 feet tall and weighing 185 pounds) were emptied into rectangular brass hoppers that were located within an enclosed wall system designed to contain accidental explosions. The hoppers delivered smokeless powder to the canning table via copper tubing through a concrete wall. The copper tubing was fitted with two quick-action valves, one before and one after the concrete wall.

possible that DNT was a component of smokeless powder.

Buildings 202 J and 202 K

These buildings were used for oil storage to support the operations at Buildings 5 and 6. The buildings were 6 feet wide, 13 feet long, and 8.5 feet high, and were constructed on a 12-inch-thick concrete slab without drains. A maximum of four oil drums could be stored and used at each of these buildings.

1.4.2 Manufacturing Processes After 1944

General Site Layout

Appendix A, Figure 6-1 depicts the site layout of the SLAAP facility for the post-1944 operational periods. A total of eleven buildings were utilized in primary production and support roles. Five of these buildings were retrofitted from .30 caliber manufacturing operations to accommodate 105-mm Howitzer shell production (Buildings 3, 5, 6, and 9). The remaining buildings (Buildings 1, 2, 4, 7, 8, 10 and 11) were constructed in 1944.

what was the 5th building?

Primary manufacturing operations were conducted in Buildings 1 through 3. Building 1 housed billet cutting operations, Building 2 served as the forging center, and Building 3 contained the machining operations. Support functions to manufacturing operations were provided by Buildings 4 through 11. Building 4 contained air compressors, Buildings 5 and 6 provided office and laboratory space, Buildings 7 and 7A cooled noncontact waters used during manufacturing, Buildings 8 (fuel oil tank farm) and 8A (fuel oil tank pump room) delivered fuel to the rotary furnaces in Building 2, Buildings 9 and 9A through 9D generated acetylene and housed an oxygen converter and receiver all in support of Building 1 operations, Building 10 stored and supplied quench oil to Building 3 heat treating operation, and Buildings 11, 11A, and 11B generated foamite to support fire suppression efforts. **Appendix A, Figures 6-5** through **6-13** show the locations of major equipment areas in each of the buildings.

Following conversion to 105-mm Howitzer shell production in 1944, a total of 2,500,000 shells were produced for World War II until the plant was placed on standby in September, 1945. Operations were reactivated on March 25, 1951 by the Chevrolet Motor Division to support the Korean Conflict. From 1951 to 1954, the plant produced 19,094,325 shells. Plant operations were terminated on May 1, 1954 and SLAAP was placed on interim maintenance status. In

1966, the Chevrolet Motor Division reactivated the plant to support the Vietnam War. Production began in November, 1966 and continued through December, 1969. The production rate reached 600,000 shells per month shortly before operations were terminated. In total, the plant had produced a total of 23,878,646 shells in all three runs (USATHAMA, 1979).

Wastewater discharges from SLAAP were monitored periodically by the Metropolitan St. Louis Sewer District, and discharges were in compliance with applicable city ordinances. Solid wastes and some liquid wastes were removed from SLAAP for off-site disposal and recycling by a local contractor (USATHAMA, 1979).

where did the PCB contaminated chips go?

Building 1, Billet Cutting Building

Steel billets were stored in concrete and H-beam racks outside of the eastern and western steel yards next to Building 1 (see **Appendix A, Figure 6-5**). Long, 4-inch square steel billets or bars were fed into the building via conveyor systems to four nicking machines (two on the east and two on the west sides). Each nicking machine consisted of eight oxygen-assisted acetylene torches that would create a nick approximately 1/4" deep and 3/16" wide along the width of each bar. Following nicking, conveyor feeds would move the billets through a direct-contact water cooling process to eight breaking machines (each rated for 530 slugs per hour). The breaking machines were situated inside concrete pits that drained to the south of the building into the sewer system. Billet ends from each end slug were cut to size in cold saw machines. Snag grinding, as necessary, was completed on all breaks that did not meet specifications. Dust collectors with vent hoods were located directly above the nicking machines and directed fumes and fine metallic particulates into dust collectors located inside the building. Ventilators were located next to the saw and grinding machines. Liquid wastes were pumped to the facility sewer system (USATHAMA 1979). Following inspection, the finished 8-1/2" slugs were mounted on skids and transported to the forge building (Building 2).

Building 2, Forge Building

Building 2 (**Appendix A, Figure 6-6**) served as the forge building. Building 2 housed a total of 10 rotary furnaces, 5 were combination natural gas- and oil-fired rotary furnaces and 5 were oil-fired furnaces for slug heating and forging. The inside of the building was almost symmetrically configured, with five rotary furnaces on each side of the building. The cut billets were received from Building 1 and fed into the rotary furnaces. Each furnace was equipped with a rectangular skid conveyor that transferred the hot billet to the sizing and descaling units. The billets were then transported to the piercing presses, where a cup was first formed through hydraulic force. Two piercing presses served each rotary furnace. Following piercing, the billets were then transferred to the hydraulic presses and draw benches, where they were drawn through a series of progressively smaller ring dies. After drawing, the formed billet was inspected and cut to length at the hot cut-off machine. One cut-off machine was present at each rotary furnace unit. The shells were then transferred by the air cooling conveyor to the water quench tanks. A descaling tank was located in the middle western half of the building. After cooling, the shells were mechanically conveyed to the second floor of Building 3 by an elevated covered bridge that connects these two buildings.

Hydraulic accumulators (one on each side of Building 2) were utilized to supply hydraulic oil to the forging process. Each hydraulic accumulator consisted of 10 hydraulic pumps connected to an above ground, 5,000 gallon oil tank in the middle section of the building. Natural gas was supplied by an underground utility supply system. No. 6 fuel oil was supplied by Buildings 8 and 8A through underground fuel lines. Each furnace had a dedicated oil fuel line that came through the floor near an I-beam next to the furnace.

Electrical transformers and equipment were housed in two enclosed elevated mezzanines located in the bays between the walls and the first I-beam row inside the building. test for PCBs in area under mezzanines?

Building 3, Machining Building

The first and second floors in Building 3 were used for machining operations. **Figures 1-7** through **1-10** [EBS Figures 6-7 through 6-10] show areas in Building 3 where major equipment was located in the basement, first floor, second floor, and roof, respectively. The building housed various lathe operations; hydraulic presses; conveyors; air-driven machinery for steel cutting, shaping, and finishing; and metal preservative operations. Other equipment included welding machines; machine, electrical, and carpenter shops; and a small automotive shop. A self-contained liquid storage area was located on the first floor that stored various oils, solvents, and chemicals. As of January 1969, the following oils, greases, and process fluids were used:

- MR 186 - hot forging compound
- Molyshield grease - Alubo
- MX-2 Hi-Temperature grease
- Coolex # 25 coolant
- GM-3 Cold hosing compound
- Spindle oil
- Various lubricating oils (Regal, Mobil, and Shell)
- Hydraulic oil General Motors Specification 16A
- Ecnogrind
- Hot Forging Compound

contain any hazardous components?

Process fluids included (USATHAMA, 1979):

- Thinner (toluol used at a rate of 45,000 liters per month)
- Enamel 1T-E-516 (used at a rate of 159,000 liters per month)
- Primer MIL-P-223332A (used at a rate of 36,000 liters per month)
- Corrosion-preventive phosphoric acid (used at a rate of 2,500 liters per month)

The following discussion of Building 3 processes is organized to follow the flow of production.

Appendix A, Figure 6-9 shows equipment areas on the second floor of Building 3. Fourteen furnaces were located between I-beam rows 28A through 43. Rough machining equipment was also located on the second floor of Building 3. Forged shells were put through the bore nose or Sundstrand lathe (between I-beam Rows 11A and 14) followed by shot blasting (between I-beam

Rows 14 and 17). The shells would progress through the machining process from west to east, ending at the annealing furnaces at the east end of the building. Center lathes were located between I-beam rows 18 and 20, and the rough-turning gross lathe was located between I-beam Rows 21 through 25.

Appendix A, Figure 6-8 shows the location of major equipment on the first floor of Building 3. A paint stripping room was located on the east end of the building north of the garage. Quench oil tanks used to quench the shells after heat treatment in the annealing furnaces were located west of the paint stripping room. Shell washing was conducted before painting, which was conducted in paint booths west of the quench oil tanks. Shell washing included the addition of phosphoric acid, rinsing, chromic acid bath prior to painting The paint mixing room was located between I-beam Rows 28A and 32. The area outside the paint mixing room stored empty barrels. Four paint mixing stations were used inside the paint mixing room. Various lathing, welding, and grinding areas are located between I-beam Rows 6 through 24. Grinders, shapers, mills, and lathes are also located between I-beam Rows 6 through 9. A hydraulic oil reclaiming unit was located on the north side of the first floor of Building 3, between I-beam Rows 10 and 11A, and 11 B. A soluble oil mixing room was located next to I-beam Row 13 between Columns A and B.

check for Cr+

The basement (**Appendix A, Figure 6-7**) contained four transformer vaults, a cable vault, elevator pits, two quench oil transfer pump systems, two former quench oil tanks, a former sludge pit, and a former gasoline UST. The quench oil pumps supplied make-up oil from each of the quench oil tanks. A return line located between I-beams Columns E and F collected quench oil from the first floor and conveyed it to the quench oil sludge pit to remove particulates and sediment. This tank overflowed into the quench oil tank next to the quench oil sludge pit. The three quench oil tanks were hydraulically connected. The overflow from the oil sludge pit was directed by gravity to the oil tank south of the pit. The concrete floor area was located between I-beam Rows 9 and 23.

did the quench oil contain PCB ?

The roof of Building 3 contained cooling towers, paint room exhaust fans, furnace exhaust fans, and dust collectors for machining operations performed on the second floor (**Appendix A, Figure 6-10**). The cooling towers served the furnaces and cooled quench oil, hydraulic oil, and other fluids through cooling water from Building 7.

Building 4, Air Compressor Building

Building 4 was the air compressor building. Five compressors were connected to ten air intake lines, two for each compressor. The intake lines were located outside along the south wall of Building 4. **Appendix A, Figure 6-11** and **6-12** show major equipment in the basement and ground level of Building 4. Individual air filter systems were connected to each air intake outside the building. The intakes entered the building beneath the floor into the compressors. Each compressor was equipped with an intercooler and aftercooler (located in a pit below the floor level). Five air receivers were aligned outside the north wall of Building 4. A cable room and vault are located in the western portion of the basement of Building 4.

An electrical room that housed the motor control center for the air compressors and other equipment was located west of the compressors area.

Buildings 5 and 6, Headquarters and Office Building and West Office and Laboratory Building

Appendix A, Figure 6-13 presents the equipment layout for Buildings 5 and 6 during the 105-mm Howitzer production. Building 5 was primarily used for office space. It consisted of a two-story building with an elevator and restrooms. No 105-mm Howitzer shell production took place at this building.

Building 6 was also used as office space and housed an inspection department and laboratory. The laboratory consisted of a chemical department, physical department, office, dark room, and chemical storage area. A deep-etch fume hood was located along the south wall. Lockers and restrooms were located in the west end of the building.

Buildings 7 and 7A, Water Pumphouse and Cooling Tower

Appendix A, Figures 6-11 and **6-12** show major equipment at Buildings 7 and 7A. Five centrifugal pumps were used in Building 7 to support water and other cooling fluid requirements.

Buildings 8 and 8A, Fuel Storage Area and Oil Pumphouse

Former Buildings 8 and 8A are depicted in **Appendix A, Figure 6-6**. Nine No. 6 fuel oil tanks were located first north of Building 2 and then relocated in 1958 to the east side of Building 2.

Buildings 9 and 9A through 9D, Acetylene Generation Area

The acetylene generation area consisted of the Acetylene Generator Building (Building 9), the Carbide Storage Building (Building 9A), the Sludge Pits (Building 9B), the Oxygen Receiver (Building 9C), and the Driox Oxygen Converter (Building 9D). The Oxygen Receiver (Building 9C) was an AST owned by the oxygen gas supplier. **Appendix A, Figure 6-1** depicts the areas where these buildings were located.

what is this?

Building 10, Quench Oil Storage Tanks

Building 10 was a series of tanks installed to increase production of 105-mm Howitzer shells. **Appendix A, Figure 6-1** depicts these tanks. The three quench oil tanks and the quench oil sludge pit were located outdoors in front of the east end of Building 3 and supplied cooling oil (No. 6 fuel oil) to 14 quench oil tanks located on the first floor of the east section of Building 3.

Buildings, 11, 11A, and 11B, Foamite Generator Building and Hose Cart Shelters

Building 11 housed the foamite generator system. **Appendix A, Figure 6-6** shows the location of the existing and former Buildings 11, 11A, and 11B. The original system included a 15-horsepower pump system, a foamite generator, and a 4-inch-diameter foamite line that left the south corner of Building 11 and split into two main lines. Foamite was used to extinguishing fires and was made by mechanical agitation of a protein-based (normally hydrolysate) surfactant water and minor amounts of ferric hydroxide (used as foam stabilizer).

1.5 SUMMARY OF ENVIRONMENTAL BASELINE SURVEY

The comprehensive EBS [TTEMI, 2000] was completed in general accordance with American Society for Testing and Materials (ASTM) Method D 6008-96, "Standard of Practice for Environmental Baseline Surveys," and ASTM Method E 1527-97, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process."

A record search and initial site visit was conducted as part of the comprehensive EBS to identify possible areas of environmental concern at SLAAP. The record search indicated that a Notice-of-Noncompliance (NON) was issued by U.S. Environmental Protection Agency (EPA) Region VII to SLAAP for polychlorinated biphenyl (PCB) contamination in Building 3. To date, this NON has not been resolved. AMCOM has reviewed this NON with EPA Region VII and the U.S. Army Corps of Engineers (COE) is remediating the PCB contamination in Building 3. Records also indicate that underground storage tank (UST) removals at SLAAP have not been completed in accordance with MDNR requirements. Possible sitewide areas of environmental concern consist of contamination resulting from possible contaminant migration from the PURO Chemical storage facility (formerly part of SLOP) located south of the installation, as well as friable asbestos-containing materials (ACM), lead-based paint (LBP) and PCBs contained in original fluorescent light ballasts found at SLAAP.

How is the COE remediating the PCBs ??

The following building-specific possible areas of environmental concern were identified through the records reviewed and the initial site visit of the comprehensive EBS:

- Electrical equipment in Buildings 1, 2, and 4 have oils suspected of containing PCBs.
- Spilled oil was identified in Buildings 1, 2, 3, and 5.
- Concrete-filled hydraulic oil pits, sumps, and floor drains were identified in Building 1.
- Two pits connected to the sewer system were observed at Building 1.
- Debris was present throughout Buildings 1, 2, and 4.
- Building 2 contained subgrade pipes for distributing PCB-contaminated hydraulic oil.
- Soil near the chip chute in the basement of Building 3 is suspected of containing PCBs and pesticides.
- Oil staining was present along the far east foundation wall, on the floor, and on support columns in the vicinity of the quench oil pump room in the basement of Building 3.
- Suspect ACM and suspect PCB-contaminated metal shavings were observed on the basement floor of Building 3.
- A steel separator tank was identified in the south-central portion of the basement of Building 3. The tank was filled with a dried, oxidized material. This material may be of environmental concern. Other pieces of equipment were located in the basement.
- Cracks in the PCB remediated concrete cap were observed on the first floor of Building 3.
- Paint used to seal the steel structures on the first floor of Building 3 was cracking and peeling.
- A solvent room with a drain connected to the sewer system was identified in Building 3 plans.

- A room on the second floor of Building 3 contained an emergency power supply unit. This unit may contain lead-acid or nickel-cadmium batteries.
- A remote quench oil-fill pipe was located near the northeast corner of Building 3.
- The compressor pits in Building 4 are suspected of containing PCB-contaminated compressor oils.
- Ash was observed in a hearth in Building 6.
- The aboveground storage tanks formerly present at Building 8, east of Building 2, are suspected of having leaked and spilled fuel oil.
- USTs have not been officially closed, and may present a possible environmental concern.

Possible PCB contaminated oil spill on dirt floor of basement (east end) of Bld #3

Phase I EBS results were presented to the MDNR on April 23, 1999 and EPA Region VII. The Phase I results were used to develop a scope of work that included completion and sampling of soil borings, installation and sampling of monitoring wells, wipe sampling, surface soil sampling, concrete core sampling, and an ACM survey. The scope of work for investigating the aforementioned possible areas of environmental concern was coordinated between TTEMI and AMCOM and verbally endorsed by EPA Region VII and MDNR.

Phase II EBS activities were completed in two separate sampling events. The first Phase II sampling event identified areas of contamination and the second Phase II sampling event was performed to further assess and characterize these areas. During a meeting held at the EPA Region VII offices in Kansas City, Kansas, on September 9, 1999, the results from the first Phase II sampling event were reviewed to assess additional areas to investigate, address PCB sampling to resolve the outstanding PBC NON, and additional locations to sample to address the unresolved, outstanding UST cleanup. The first Phase II results were reviewed sitewide and building-by-building. The scope of work for the second phase of the EBS Phase II was developed and work was undertaken based on the outcome of the September 9, 1999 meeting. The data collected during Phases I and II were used to compile the results of the EBS. The draft final EBS report was submitted for review on March 17, 2000 and a meeting to review the report took place on March 31, 2000 at the EPA Region VII offices. During that meeting, the draft final EBS report was briefly reviewed. It was agreed that additional information was required, primarily related to:

1. manufacturing activities that took place at SLAAP when it was part of SLOP
2. the EBS analytical data validation report performed by IT Corporation was necessary to assess the validity of the analytical results obtained during the EBS
3. the cleanup criteria used for comparison of analytical results should not be limited to the State of Missouri voluntary cleanup program (CALM), but should be expanded to incorporate other cleanup criteria, including the EPA Region IX preliminary cleanup goals criteria

The revised final EBS report, dated December 28, 2000 incorporated the additional information requested at the May 31, 2000 meeting. The EBS conclusions and recommendations are presented in the EBS report dated December 28, 2000 and are summarized **Table 1-12.**

EPA Region VII and MDNR provided comments to AMCOM on the revised final EBS report. TTEMI prepared preliminary draft responses to both EPA Region VII and MDNR comments, which were reviewed during a May 17, 2001 meeting held in St. Louis, Missouri. Attendees to this meeting included representatives from AMCOM and its contractor SEMCOR, EPA Region VII, MDNR, CENWK, URS, Arrowhead Contractors, Inc. and TTEMI. After this meeting AMCOM undertook the task of documenting the outcome of the review comments and addressing the comments that were not proposed to be deferred to this site-specific EBS. The minutes of the meeting (SEMCOR, 2001) indicated the following remaining areas of concern for the site specific EBS.

Site-wide:

- Areas where EBS mentions areas of environmental concern
- Comprehensive look at sewer system
- UST areas
- Transformer areas
- Metals storage areas
- Sumps

Building 1:

- Sumps
- Soils around break machines – inside
- Subsurface under building – PCB, TPH, solvents

Building 2:

- Subsurface under building – TPH, SVOCs, PCBs, solvents (sample in grid pattern)
- Sediment in manhole - solvents

Former building 8:

- Pipe chase connecting to Building 2

Building 3:

- Catch basins – basement of Building 3
- Soils in basement of Building 3
- Under floor of east end of Building 3
- Area with high gasoline hit – near UST next to Building 3
- West end of Building 3 for solvents in water
- Elevator

Building 4:

- Sumps, compressors

Buildings 5 and 6:

- Lab
- Dark room
- Elevator
- South of buildings – small storage areas

Key personnel for associated activities are summarized below:

KEY PERSONNEL	ORGANIZATION	ROLE	RESPONSIBILITY
Sandy Olinger	AMCOM	Project Manager	• Contract management
Dan Mroz	CENWK	Project Manager	• Client representative for the program
Curt Baer	CENWK	Technical Manager	• Management of the SLAAP project • Technical oversight
Dave Daniel	CENWK	Risk Assessor	• Technical oversight of the risk assessment process
Masud Zaman	CENWK	Geologist	• Technical oversight of geology
Francis Zigmund	CENWK	Project Chemist	• QC oversight of chemistry
Laura Percifield	CEWES	QA Laboratory Supervisor	• QA sample analysis
Wayne Smith, P.E.	URS	Program Manager	• Program Manager for Contract DACW41-96-D-8014
Richard Johannes, P.E.	URS	Principal In Charge	• Task Order Principal In Charge
Robert Skach, P.E.	URS	Project Manager	• Contractor representative for the program • Primary point-of-contact with CENWK and AMCOM • Overall responsibility for all phases of work • Personnel, scheduling, and budget control
John Moylan	URS	Task Order Quality Control Officer	• Technical Oversight
Phil Jones	URS	Certified Industrial Hygienist	• Overall responsibility of URS Health and Safety Program
David Convy	URS	Independent Technical Reviewer	• Peer Reviewer for the SAP and RI reports
Peter Tong	URS	Independent Technical Reviewer	• Peer Reviewer for the Baseline Risk Assessment
Dana Monroe	URS	Chemical Quality Control Officer	• Preparation of the QAPP and Quality Control Summary Report • Directing overall chemical QA/QC program
To Be Determined	URS	Site Safety and Health Officer	• Oversight of Site Health and Safety • Designates deputy Site Safety & Health Officer for field work
To Be Determined	URS	Chemical Quality Control (CQC) Representative	• CQC responsibilities as defined in this FSP • Prepare technical reports • Manage and coordinate field work • Primary point-of-contact for subcontract laboratories and QA laboratory

KEY PERSONNEL	ORGANIZATION	ROLE	RESPONSIBILITY
Doug Monroe	URS	Project Chemist	• Preparation of Quality Control Summary Report • Technical communications with laboratory • Primary point-of-contact for subcontract laboratories and QA laboratory
Matt Phoenix	URS	Environmental Engineer	• Provide technical input for work plan development • Download of laboratory electronic data files into database • Generation of data tables and graphs for reports
Jim Garrison	URS	Human Health Risk Assessor	• Task Manager for Human Health Risk Assessment
Carla Dods	URS	Regional Health and Safety Officer	• Review Health and Safety Plans • Ensure compliance with URS Health and Safety standards
Charlotte McLain	URS	Procurement Specialist	• Procurement of supplies and equipment
John Borell	URS	Contract Administrator	• Preparation of payment vouchers
Carolyn Horst	URS	Contract Specialist	• Preparation and tracking of subcontracts
Greg Wallace	Arrowhead	Project Geologist	• Coordination with other SLAAP projects • Technical input regarding site geology • Liaison with URS and CENWK
Bryant Kroutch	Arrowhead	FSP Task Leader	• Provide technical input for preparation of FSP and field activities

The site characterization sampling strategy described in this FSP is based on the Data Quality Objective (DQO) process presented in *EPA Soil Screening Guidance: Technical Background Document* (EPA, May 1996). Based on this guidance, a sampling strategy has been developed and organized consistent with the steps of the DQO process:

- State the problem
- Identify the decision
- Identify inputs to the decision
- Define the study boundaries
- Develop a decision rule
- Specify limits on decision errors
- Optimize the design for obtaining data

Each of these steps is discussed below.

3.1 DATA QUALITY OBJECTIVES PROCESS

3.1.1 State the Problem

Collect sufficient data to support transfer of the property consistent with the Finding of Suitability to Transfer (FOST) process.

3.1.2 Identify the Decision

The FOST process determines that a real property is environmentally suitable for transfer because:

- The property has never been contaminated (no release or disposal of hazardous substances or petroleum products has occurred); or
- The property has been contaminated but is still suitable for transfer because
  - environmental remedial actions have been taken to protect human health and the environment consistent with the property's intended use; or
  - the contamination is present at levels that do not represent a threat to human health and the environment, consistent with the intended use.

Because a FOST commonly incorporates the intended future use of the real estate, the FOST may also include deed restrictions for the property. Such restrictions may be necessary to ensure that unintended uses of the property do not disrupt remediation activities, jeopardize the protection provided by those remedies, or otherwise alter the conditions that allowed an initial finding of environmental suitability.

Accordingly, the data collected in this investigation must support an evaluation of site risk and compliance with environmental regulations. If either of these evaluations suggest remedial actions are required, sufficient data must exist to facilitate the evaluation and selection of remedial alternatives.

3.1.3 Identify Inputs to the Decision

This step identifies the inputs to the decision process, including the basis for investigation and the applicable field sampling and analytical methods. The inputs for deciding whether to investigate are based on recent site visits and on information contained in the comprehensive EBS Report (TTEMI, 2000).

For sampling of the selected areas of SLAAP, the inputs for deciding whether to investigate are largely based on the findings of the EBS (summarized in **Table 1-12** of this document). **Table 3-1** presents the sampling approach and rationale for each of the environmental areas of concern identified in the comprehensive EBS report.

3.1.4 Define the Study Boundaries

This step in the DQO process defines the sample population of interest (areas and depths of concern), subdivides areas of concern into manageable units, and specifies temporal or practical constraints on the data collection.

Population of Interest

Media of interest include concrete, surface soil, subsurface soil, surface wipes, wastewater, sediment, surface water, and/or groundwater. **Table 3-1** details the rationale on a building-by-building basis for collecting site characterization samples to address each of the areas of environmental concern identified in the comprehensive EBS report. **Table 3-2** provides a summary of sample collection activities for each specific medium.

Areas of Concern

The limits of each area of concern were developed based on the information presented in the comprehensive EBS report with regard to previous environmental investigations conducted at the site and process knowledge of the munition production operations. The locations of each area of concern and proposed sampling locations are shown on **Figures 3-1** through **3-11**.

Constraints on Data Collection

Constraints on the collection of data include physical structures (such as the presence of buildings, railroad tracks, and the site-wide sewer system, etc.), project schedule/timing and funding. Physical constraints will be accommodated by selecting sampling techniques that are most compatible with data needs and access to each area of concern. For example, video surveying of the sewer line or utilization of soil gas surveys to delineate areas for "hot-spot" investigation should minimize physical constraints associated with "blanket-approach" investigations.

Project schedules will be optimized through a phased-approach such that "step-out" investigations are pre-planned and approved in the event that results from phase one investigations suggest additional data are necessary. In this way, most if not all, of the investigations will be completed during one mobilization to the site.

3.1.5 Develop a Decision Rule

Ultimately, the decision rule governing this FSP is a finding that the property is environmentally suited for transfer in accordance with FOST guidelines. For this finding to occur, the intended current and future use of the property must be consistent with protection of human health and the environment. Accordingly, data must be collected of sufficient quantity and quality to support an assessment of risk posed by any contamination such that appropriate remedial measures can be developed and selected.

The sampling program activities that evaluate the nature and extent of contamination within each area of concern identified in the comprehensive EBS report contain both primary and contingency sample locations and collection protocols. The decision of whether or not to implement the contingency investigations will be made by comparing analytical results from the primary samples to EPA Region IX Residential Preliminary Remediation Goals (PRG's) and MDNR CALM Scenario A levels, which are based on residential exposures. The selection of residential exposure limits has been made not because future residential uses are anticipated, but rather to determine the detection limits that allow for maximum flexibility in the decision making process. For compounds where the PRG's and CALM levels are not the same, the more conservative value will be used for making the decision. If the analytical result for a sample is greater than, or equal to, the PRG or CALM value, one or more contingency samples will be collected and analyzed for that particular compound.

Data collected for a risk assessment should be unbiased and of a sufficient scope to permit the evaluation of the risk posed by exposure of receptor populations to all suspect media at the site. The primary media of concern at the site are soils, since removal of any existing structures or intrusive activities at the site will create exposure to soil. Surface soils (0-6 inches bgs) are the most likely source of exposure to future site workers or other populations. Subsurface soils represent a medium of potential exposure to individuals who might perform trenching as part of construction or utility work. Trenching and excavation activities will not likely be any deeper than the deepest utility lines at the site, approximately 10 ft bgs. For these reasons, risk assessment samples must include data from soils at depths ranging from 0-10 ft bgs. There are no exposure pathways for groundwater at the site since contamination is confined to perched zones deeper than 12 ft bgs and there is no current or anticipated future use of this groundwater. There is no surface water at the site; therefore, no risks are posed by this medium. Contaminants on building surfaces present a potential exposure pathway, but since the best practice for contaminated surfaces is elimination of the exposure pathway (i.e., decontamination or encapsulation), no risk assessment of building surfaces is proposed. Asbestos and lead-based paint are also potential sources of risk, but since building remediation standards are already established for these contaminants, no risk assessment of them is planned. Furthermore, since it is assumed that any future owners of the site will address the remediation of asbestos and lead-based paint, no investigation or remediation activities are currently planned for these media. Air samples will not be collected since the source of risk at the site is contaminants released into the air by the soils, not the air itself. These data will be evaluated with respect to carcinogenic and non-carcinogenic affects, and the quantified risk values will be utilized to determine whether or not remediation is necessary for the property to be transferred.

what about surface runoff?

anticipating early/dirty transfer?

To provide an unbiased source of data for the risk assessment, the data to be used as the sole inputs to the risk assessment will be collected using a systematic approach described in the EPA's *Guidance for Data Useability in Risk Assessment* (USEPA, 1992). Each building (i.e., area of concern) has been divided into sampling grids consisting of at least 10 equally sized grid units using a "best-fit" approach. Soil borings have been systematically placed at the center of each grid unit, as shown on **Figure 3-11**. Samples collected from all risk assessment soil borings will be analyzed for VOCs, SVOCs, PCBs, and metals. Samples from the grids around buildings 3, 4, 5 and 6 will also be analyzed for pesticides since those buildings contain basements in which historical pesticide use is suspected.

3.1.6 Evaluate Decision Errors and Optimize the Design

Given the typical variability of contaminant concentrations within an area, practical constraints on sample sizes, and sampling or measurement error, the data collected may be inaccurate or non-representative and can lead to incorrect decisions. A decision error occurs when sampling data mislead decision makers into choosing a course of action that is different from, or less desirable than, the course of action that would have been chosen with complete information.

Data obtained from sampling and analysis are never completely representative and accurate. Furthermore, the costs of trying to achieve complete results can often outweigh the benefits. Consequently, uncertainty in data must be tolerated to some degree. The DQO process controls the degree to which uncertainty in data affects the outcomes of decisions that are based on those data. This step of the DQO process allows the decision makers to set limits on the probabilities of making an incorrect decision.

The DQO process utilizes hypothesis tests to control decision errors. When performing a hypothesis test, a presumed or baseline condition, referred to as the "null hypothesis", is established. This baseline condition is presumed to be true unless the data conclusively demonstrate otherwise, which is called "rejecting the null hypothesis" in favor of an alternative hypothesis.

When the hypothesis test is performed, two possible decision errors may occur:

1. Decide not to remediate an area (i.e., "walk away") when the correct decision (with complete information) would be to "remediate"
2. Decide to remediate when the correct decision would be to "walk away."

The first error would be a "false negative", i.e., failure to detect the presence of contaminants above allowable limits. The second error would result in a "false positive", i.e., concluding that contaminants are present at levels above allowable limits when, in fact, they are not.

False negatives are very unlikely. Laboratory reporting levels will be established commensurate with PRGs for typical residential land use and exposure scenarios (see QAPP, **Table 2**). Given the industrial location and likely future use of the site, the residential PRGs will be well below any resulting calculated remediation threshold, thereby essentially eliminating the possibility of making a false negative decision.

A false positive error could occur if the risk assessment utilized only data obtained from "hot spot" areas. Under this scenario, concentrations utilized in risk calculations would be prejudicially higher than representative conditions (as a result of predetermining sample locations in the vicinity of known contamination). While this approach is required to define the lateral extent of contaminants in each area of concern, conducting investigations in only these areas could bias the environmental data. Consequently, risk assessment data will be collected at systematically determined locations throughout each area of concern.

3.2 SAMPLE COLLECTION SUMMARY

A summary of primary and contingency samples to be collected during the field efforts is provided on a building-by-building basis for each media of concern in **Table 3-2**.

This section presents a description of the field activities and protocols to be implemented during the site characterization and risk assessment sampling efforts at SLAAP. The field activities addressed in this section include:

- Sample Layout and Utility Clearance
- Soil Borings and Sampling
- Surface Water and Sediment Sampling
- Concrete Floor Sampling
- Test Pit and Test Trench Excavation and Sampling
- Wipe Sampling
- Video Surveying of Sanitary Sewers
- Refractory Brick Sampling
- Containerized Decontamination Fluid Sampling
- Equipment Decontamination

Details regarding sampling rationale, sample locations, analytes of interest, etc. are provided in **Table 3-1**. Procedures for field documentation, sample packaging and shipping, handling of investigation derived waste, and field instrument calibration are presented in subsequent sections of this FSP. Protocols associated with laboratory analysis of environmental samples, including container requirements, analytical methods, and collection of QA/QC samples are discussed in the QAPP. Health and safety procedures associated with field sampling activities are specified in the SHERP. Quality control procedures are detailed in the Quality Control Plan (QCP).

4.1 SAMPLE LAYOUT AND UTILITY CLEARANCE

Prior to sampling activities, field personnel will layout the sample locations as indicated on **Figures 3-1** through **3-11**. Sample locations will be established in the field by measuring from nearby existing facilities as presented in this FSP. If field personnel observe any obstructions that would render a predetermined sample location inaccessible, the sample location may be moved to the nearest accessible location. Each location will be marked by placing a wooden stake or pin flag or by marking on the floor/pavement surface with spray paint. Sample locations will also be labeled with the corresponding sample ID/number (refer to Section 5.3). Using available as-built drawings and utility maps, sampling personnel will check the initial locations of samples outside the building relative to underground utilities. Additionally, Missouri One Call (1-800-DIG RITE (344-7483)) will be contacted to dispatch utility company representatives for field locating existing utilities (i.e., steam, water, gas, telephone, electric, and sewer). If conflicts with utilities are identified, the sample location(s) will be moved to the nearest safe location. The locations of utilities will be measured in the field from existing site features with a tape and marked on site drawings and field notebooks for future reference.

4.2 SOIL BORINGS AND SAMPLING

Soil borings will be advanced to sample the soil at numerous locations (refer to **Table 3-2**) to investigate possible surface and subsurface contamination and to collect information for risk assessment purposes. Soil borings will be advanced to a depth sufficient to collect samples from the specified depth intervals below the top of native soil or soil fill material. For most borings, the sampled depth intervals will be 0 – 6 inches, 4 –5 feet, and 9 – 10 feet beneath the top of the soil (i.e., under pavement and granular bedding materials). Soil samples associated with sewer lines will be collected at 0 – 6 inches, 4 – 5 feet, and 9 – 10 feet below the granular bedding material near the location where a video survey indicates a suspected leak or breach. If refusal is encountered prior to reaching the required depth, the soil boring will be reattempted at a new location within 3 feet of the initial borehole. If refusal is encountered during the subsequent boring, a sample will be obtained from the one-foot interval immediately above the point of refusal in the second borehole.

Soil borings will be completed by one of two methods. Where accessibility of equipment is not a concern, soil borings will be advanced using a hydraulic push probe (i.e. Geoprobe or equivalent) mounted on a vehicle appropriate for the location (i.e. a rig in open areas, a track mounted device in smaller spaces). Soil samples will be collected from a lined core sampler (i.e. Macro core sampler with acetate liner) pushed or driven by the probe rods. The core sampler will yield a continuous soil core approximately 4 feet in length. In areas that are not accessible to the hydraulic push rig, such as basements or other areas with insufficient clearance, samples will be collected manually using a stainless steel hand auger or small barrel drive sampler (tube sampler).

The majority of the planned soil borings are located beneath concrete flooring or other paved areas. Consequently, it will be necessary to clear the concrete/asphalt prior to sampling. Pavement will be removed either by using a concrete core attachment to the hydraulic push rig or by a using a concrete saw (with diamond cut blade) and pneumatic jack hammer. In areas where samples will be collected with a hand auger or small barrel drive sampler, the gravel base underlying the concrete/asphalt will be cleared to expose the top of the soil. The gravel will be loosened with a power auger and removed using a shovel or post-hole digger.

The general procedure for collecting samples from soil borings will be as follows:

- The soil boring location will be cleared of vegetation or debris. As necessary, concrete, asphalt, and gravel base will be removed using methods referenced above.
- The sampling device (core sampler, hand auger, or small barrel driver) will be advanced to the appropriate depth interval and then retrieved from the borehole.
- Soil from the specified depth interval will be removed from the sampling device and placed into a stainless steel mixing bowl. Prior to placing the sample in the mixing bowl, a sample for VOC analysis, if required, will be collected from the sampling device using a 5-gram or 25-gram Disposable En Core™ Sampler, or equivalent. The sampler will be filled and sealed in accordance with the manufacturer's recommendations.
- After collection of the VOC sample, the remaining soil will be thoroughly mixed with a stainless steel spoon for the purpose of homogenizing the material.

- After mixing, a sufficient quantity of soil will be placed into an appropriate sample container (refer to QAPP, Section _____). The container label will be completed by the sampler as described in Section 5.4.1.
- Field QA/QC samples (refer to QAPP, Section ____) for VOC analysis, if required, will be collected at the same time and from the same material as the investigative VOC sample. The remaining duplicate and split samples will be collected from the mixing bowl after the soil is homogenized.
- Immediately following collection and labeling, soil samples will be placed into a cooler with ice or a refrigerator and then transported to the field office for packaging, completion of chain-of-custody documentation, and shipment to the designated analytical laboratory(ies) as discussed in Sections 5 and 6.
- The sampling equipment (core sampler, auger, mixing bowl, etc.) will decontaminated between each sample location and between each depth interval as described in Section 4.10.
- For possible future reference (i.e. location/elevation surveying), the sample location will be marked with a wooden stake or spray paint and labeled with the sample ID.

All relevant information for each sample will be recorded on a Sample Collection Field Sheet (refer to **Figure 5-2**), including, but not limited to:

- Date/time of sampling
- Sampling team members present
- Sample location
- Sample number
- Sample depth and interval
- Description of the sample location with sketch, if applicable
- Analyses required
- QA/QC sample IDs
- PID/OVA readings
- Visual classification of soil
- Other visual observations, such as staining or free product

Boring logs (refer to **Figure 5-3**) for each soil boring will be completed. The boring logs will be submitted as appendices to the EBS report. All soil samples will be visually classified in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils (Visual - Manual Procedure). The original field logs will be considered a legal document describing the materials penetrated and the specifics of the boring and sampling methods used. The field logs will only be edited to add pertinent information not available at the time of the boring was completed (i.e., survey information). Information on the boring logs will include, but not be limited to, the following:

- Date and start and completion times

- Names of sampling team members
- Weather conditions
- PID/OVM measurements
- Surface elevation (if available)
- Boring log scale will be 1-inch per foot of borehole
- Borehole diameter
- Sample intervals
- Description of the soil sample (include soil classification, staining, odors, or other pertinent information)
- Depth at which significant changes in soil properties occur
- Gradational changes in major lithologic units, including thin lenses and layers and the thickness of each stratum
- Description of material including soil type, consistency or density, color, relative moisture content, secondary features (i.e., worm holes, root castes, fractures, staining, precipitate formation, organic matter, debris), bedding features, and USGS designation
- Identification of any boring problems (i.e., refusal or cave-ins)
- Description of any tools lost or dropped into the borehole
- Total depth of the completed hole
- Type of backfill material (include ratio of materials used).

Extra soil from the sample boring will be returned to the borehole. Following collection of the last sample at a location, the borehole will be backfilled with a dry mixture of 50 percent sand and 50 percent granular bentonite. Paved areas will be backfilled to grade with AB-3 crushed rock or similar material.

4.3 WASTEWATER AND SEDIMENT SAMPLING

Samples of wastewater (if encountered) will be collected from the interior of various sewer manholes. In addition, sediment samples will be collected from the interior of sewer manholes, utility vaults, and process equipment sumps. Field personnel will not be permitted to enter these structures.

Samples of wastewater will be obtained at each manhole location with a decontaminated bottle sampler attached to a PVC pipe or other extended handle. Sediment samples may be collected by one of the following methods, depending on site conditions and field personnel preference:

- Scoop or trowel attached to a PVC pipe or other extended handle
- Hand auger
- Small barrel drive sampler (tube sampler)
- Clam shell sampler.

To the extent possible, sample material will be collected from the entire depth profile of the sediment.

The general procedure for surface water and sediment sampling will be as follows:

- The sampling device will be inserted into the material and removed.
- For wastewater samples, a sufficient quantity of water will be poured directly from the sampling device into appropriate sample containers (refer to QAPP, Section _____). The container label will be completed by the sampler as described in Section 5.4.1.
- Water quality measurements of (pH, salinity, conductivity, and temperature) will also be made at the time of sampling.
- For sediment samples, sampled material will be removed from the sampling device and placed into a stainless steel mixing bowl. Prior to placing the sample in the mixing bowl, a sample for VOC analysis, if required, will be collected from the sampling device using a 5-gram or 25-gram Disposable En Core™ Sampler, or equivalent. The sampler will be filled and sealed in accordance with the manufacturer's recommendations.
- The remaining material will be thoroughly mixed with a stainless steel spoon for the purpose of homogenizing the material.
- After mixing, a sufficient quantity of sediment will be placed in appropriate sample containers (refer to QAPP, Section _____). The container label will be completed by the sampler as described in Section 5.4.1.
- Field QA/QC samples (refer to QAPP, Section ____) for VOC analysis, if required, will be collected at the same time and from the same material as the investigative VOC sample. The remaining duplicate and split samples will be collected from the mixing bowl after the material is homogenized.
- Immediately following collection and labeling, samples will be placed into a cooler with ice or a refrigerator and then transported to the field office for packaging, completion of chain-of-custody documentation, and shipment to the designated analytical laboratory(ies) as discussed in Sections 5 and 6.
- The sampling equipment will decontaminated between each sample location as described in Section 4.10.
- For possible future reference (i.e. location/elevation surveying), the sample location will be marked with a wooden stake or spray paint and labeled with the sample ID.

A Sample Collection Field Sheet will be completed (refer to **Figure 5-2**) and, at minimum, the following information will be recorded:

- Date/time of sampling
- Sampling team members present
- PID/OVA/CGA readings
- Sample location
- Sample number

- Depth to bottom of structure
- Depth of water or sediment where sample was obtained
- Analyses required
- QA/QC sample IDs
- Visual observations, such as free product, sheen, or staining

4.4 CONCRETE FLOOR SAMPLING

Concrete samples will be collected from oil-stained areas inside buildings at locations corresponding to several soil borings . Concrete floor samples will be collected from 0 – 1 inches and 2 – 3 inches below the floor surface as follows:

- At the designated location, the concrete floor will be cored to the appropriate depth using a concrete core sampler with a coring bit of not less than 1 inch in diameter. What about the cap on the floor of Bld #3?
- The concrete core sample will then be saw-cut into individual sections corresponding to the sample depth interval.
- The individual core sections will then be placed into the appropriate sample containers (refer to QAPP, Section ____) and the container label will be completed by the sampler as described in Section 5.4.1. [Note: Further processing of the samples, such as pulverizing, will be performed by the analytical laboratory.]
- Immediately following collection and labeling, samples will be placed into a cooler with ice or a refrigerator and then transported to the field office for packaging, completion of chain-of-custody documentation, and shipment to the designated analytical laboratory(ies) as discussed in Sections 5 and 6.
- The sampling equipment (core sampler bit and saw blade) will be decontaminated between each sample location as described in Section 4.10.

A Sample Collection Field Sheet (refer to **Figure 5-2**) will be completed, and, at minimum, the following information will be recorded:

- Date/time of sampling
- Sampling team members present
- Sample location
- Sample number
- Depth intervals sampled
- Description of the sample location with sketch, if applicable
- Analyses required
- QA/QC sample IDs
- Visual observation, such as oil-staining

4.5 TEST PIT AND TEST TRENCH EXCAVATION AND SAMPLING

Test pit and trench locations, as shown on **Figures 3-3** and **3-9**, include the areas beneath the foundations of the rotary furnaces in Building 2 and within the former cooling tower base near Building 7. Test pits and trenches will be excavated for purposes of observing subsurface contamination and for sampling soil and/or sediment.

Test pits and test trenches will be excavated with a rubber tire or track-mounted backhoe. Samples for chemical analysis will be obtained from the spoil pile or taken directly from the backhoe bucket using hand tools. Personnel will not enter the test pit or test trench for sample collection purposes. Samples collected from the backhoe bucket for chemical analysis will be obtained from material that has not been in contact with the sides of the backhoe bucket to avoid possible cross-contamination. Samples will be prepared, containerized, stored, and documented as described in Section 4.2 for soil borings. Sampling tools will be decontaminated between each sample and depth interval as described in Section 4.10. The excavator bucket and arm will be decontaminated between test pit/trench locations.

Test pits below the rotary furnace foundations in Building 2 (refer to **Figure 3-3**) will require that the concrete be removed to expose underlying soil. A ram-hoe attachment to the excavator arm will be used to penetrate the concrete. Samples of soil from beneath the foundation ring will initially be collected from the 0 – 6 inch and 4 – 5 foot intervals below the top of the soil. Based on the analytical results from the initial samples, contingency borings may be completed to sample deeper intervals. Contingency soil borings will be completed using a hand auger or small barrel drive sampler according to the procedures discussed in Section 4.2.

A test pit in the area of the former cooling tower near Building 7 (refer to **Figure 3-9**) will initially be excavated to a depth that exposes a layer of sediment derived from cooling tower discharges. This layer is believed to be present at a relatively shallow depth. If the sediment layer is identifiable during excavation, a sample of the material will be collected. Otherwise, a soil sample will be collected from 0 – 6 inches below the top of soil. Test pit excavation will continue to a depth of 5 feet, and an additional sample will be collected from the 4 – 5 foot interval below the top of soil. Based on the analytical results from the initial soil/sediment samples, a trench may be excavated laterally from the test pit to investigate the radial extent of contamination. If this occurs, contingency samples will be collected every 10 feet from the original test pit until sample results indicate the absence of contamination. The contingency samples will be collected from the sediment layer (if identifiable) or 0 – 6 inches and from the 4 – 5 foot interval below the top of soil.

Visual Classification of Soils forms (refer to **Figure 5-4**) will be completed for each test pit and trench and submitted as appendices to the site investigation report. Soil samples will be visually classified in general accordance with ASTM D2488-93, Standard Practice for Description and Identification of Soils (Visual - Manual Procedure). Relevant information to be recorded on the forms is similar to the list of items presented for soil boring logs (refer to Section 4.2).

The test pits and trenches will be backfilled with the excavated soil. If any test pits or trenches are left open overnight, protective rope, construction tape, or other appropriate barricades will be placed around the excavation.

4.6 WIPE SAMPLING

Wipe samples will be collected from the transformer base in the basement of Building 4 and from ventilation ductwork in the hearth room in Building 6. The following is the general wipe sampling procedure to be followed during applicable field activities:

- All undesirable loose material will be removed from the sample collection area.
- A clean, disposable template with an opening of exactly 1 square ft (or 100 square cm for PCBs) will be prepared.
- The template will be secured over the area to be sampled.
- The wipe media will be removed from the box and may only be handled using a new pair of impervious gloves.
- If a damp wipe is required, the wipe media will be moistened with distilled water or appropriate solvent as specified by the analytical laboratory. The type of wipe media used (i.e., glass fiber or paper filter) will also be confirmed with the laboratory.
- The wipe sample will be started at the outside edge of the template and progress toward the center, making concentric squares of decreasing size.
- After completing the sample, the wipe will be folded with the exposed side in, and then folded over again. The wipe will then be placed in a sample container (refer to QAPP, Section _____) and the container label will be completed by the sampler as described in Section 5.4.1.
- Immediately following collection and labeling, samples will be placed into a cooler with ice or a refrigerator and then transported to the field office for packaging, completion of chain-of-custody documentation, and shipment to the designated analytical laboratory(ies) as discussed in Sections 5 and 6.
- One blank sample will be created for each sample area by using an unused wipe and preparing the sample, without contacting any surfaces, as described above.
- The disposable template and impervious gloves used to collect the sample will be disposed of after collection of the sample is complete.

A sketch of the sampling area will be included on the Sample Collection Field Sheet (refer to **Figure 5-2**) and/or in the field logbook. If possible, the template cutout area will be traced with crayon or marker.

4.7 VIDEO SURVEYING OF SANITARY SEWERS

A video survey of the main sewer lines at SLAAP will be conducted to identify suspected breaches in sewer pipelines that may have historically been potential conduits for releasing contaminants to the subsurface. The video survey will be completed by a subcontractor using closed-circuit television (CCTV) technology, or equivalent. The specific procedures to be followed in the field will be provided in the subcontractor's Standard Operating Procedures. The following are general protocols/criteria for conducting the video survey:

- All electrical components will be designed and constructed to prevent the equipment from igniting flammable or explosive vapors (i.e. explosion-proof equipment).
- The CCTV equipment will be capable of being submersed in water.
- The CCTV will be capable of panning 360 degrees within the pipeline.
- Prior to the video survey, the sewer lines will be checked for obstructions that would interfere with movement of the CCTV equipment. The obstructions shall be removed by water-jetting, bucket scraping, tap cutting (for tree roots), or other appropriate methods.
- The CCTV unit will be advanced through the pipeline by pulling (i.e. winch) or using a self-powered, remote-controlled unit.
- The location of any suspected breaches in a given pipeline will be recorded in linear feet from the point of entry of the CCTV unit.

4.8 REFRACTORY BRICK SAMPLING

The refractor brick associated with the rotary furnaces in Building 2 will be sampled to determine the asbestos content. Small pieces the brick material will be collected by hand, placed into a plastic sample bag, and an appropriate label will be affixed (refer to Section 5.4.1). If present, samples of mortar material will also be collected in the same manner. Sampling personnel will wear new impervious gloves to handle the samples.

4.9 CONTAINERIZED DECONTAMINATION FLUID SAMPLING

Decontamination fluids will be handled and containerized as specified in Section 7 (Investigation Derived Waste). Sampling and chemical analysis of these fluids will be required to evaluate alternatives for disposal. Decontamination fluids will be sampled via an access port at the top of the container (i.e. storage tank or drum) using a decontaminated bottle sampler. The fluid will then be transferred to the appropriate sample containers (refer to QAPP, Section _____) and an appropriate label will be affixed (refer to Section 5.4.1). Samples for chemical analysis will be placed into a cooler with ice or a refrigerator within 5 minutes of collection and then transported to the field office for packaging, completion of Chain-of-Custody documentation, and shipment to the designated analytical laboratory(ies) as discussed in Sections 5 and 6. A Sample Collection Field Sheet (refer to **Figure 5-2**) will be completed and, at minimum, the following information will be recorded:

- Date/time of sampling
- Sampling team members present
- Sample number
- Quantity of decontamination fluid in container
- Location of container sampled
- Contents of container(s) sampled
- Analyses required

4.10 EQUIPMENT DECONTAMINATION

Decontamination of equipment will be performed to avoid cross-contamination of samples collected for chemical analysis, and to limit the migration of contaminants off-site and between on-site work areas. Decontamination of soil boring, coring, excavating, and sampling equipment will occur at the exclusion zone of the intrusive activities or at central decontamination stations (if required).

Equipment will be inspected when it arrives on site for evidence of gross contamination (excessive mud or grease). If gross contamination is present, the equipment will either be returned to the vendor for cleaning or cleaned on-site. Following the initial inspection, equipment will be decontaminated at the location of the first activity. Final decontamination of drill rigs and excavation equipment will be conducted at the location of the last activity or at a central decontamination station. All reusable equipment that may come in contact with samples for chemical analysis will be decontaminated between collection of samples.

Decontamination will consist of scraping and scrubbing to remove encrusted materials, if necessary, followed by a soap (nonphosphate detergent) and water wash and then a potable water rinse. Alternatively, the equipment may be cleaned with a high-pressure hot water/steam cleaning unit. Sampling equipment will then be rinsed with analytical grade heptane followed by rinsing with deionized/distilled water.

Test trench excavation equipment (i.e., excavator bucket) and sampling equipment will be decontaminated between each trench location. Decontamination will take place at or near each trench location. Decontamination will be accomplished with a high pressure hot water/steam cleaning unit.

5.1 FIELD LOGBOOK

The field logbook will consist of a hard bound, water-resistant field book with numbered pages. All pertinent information regarding the site and sampling procedures will be documented in indelible ink. Notations will be made in logbook fashion with sufficient detail so that decision logic may be traced once reviewed, noting the time and date of all entries. One logbook will be assigned to each sampling team. The following information will be included in the field logbook:

- Project name and number, date, and page number at the page top
- Weather conditions, temperature, wind speed and direction and weather forecast for the day
- Name and task related title of each one of the team members present on-site
- Name and task related title of each subcontractor present on-site
- Name and title of any client representative, oversight personnel, or visitor
- Information concerning activity/sampling changes, schedule modifications, or change orders
- Deviations from approved work plans
- Results from any health and safety monitoring, and any necessary actions
- Information concerning access agreements or conversations with property owners
- Sketches and field measurements of sample locations
- Field observations
- Chronology of events
- Location, description, compass direction, date, and log of photographs
- Sample ID number(s) of all samples collected
- Other information which the author believes is important to document

At the end of each day, all field personnel maintaining a logbook will cross through the remaining space of the last page of the logbook for that day's activities, sign and date it.

The field manager or sample manager may also maintain a field logbook for recording the information presented above or for documenting other relevant information.

5.2 PHOTOGRAPHS

At each sampling location, a color photograph will be taken which shows the sampling location and its immediate surroundings. Included in each photograph will be a placard of known dimensions. The placard will be marked with information indicating which building and which portion or feature of a building the photograph is depicting. The location, description, compass direction, date, and log of each photograph will be recorded into the field logbook.

Photographs of other items of interest, such as samples, physical features, field equipment, and others, may be taken at the discretion of field personnel. Photographs of individual samples will include a placard marked with the investigation and location identifiers, and the 2-digit sample location and 3-digit sample depth (if applicable) identifiers (see Section 5.3).

5.3 SAMPLE NUMBERING SYSTEM

All samples will be identified with a unique sample ID which identifies the as described below.

5.3.1 Site Characterization Samples

The sample identification system for samples to be used for site characterization, not the risk assessment, is described below.

Format: $\#\#_B$XX-$\#\#_S$-MMYYQQQ

Where each element of the sample ID represents the following identifying information:

$\#\#_B$: Two-digit number representing the building or area of concern

examples: 01 = Building 1

02 = Building 2

SR = Sewer system

IW = Investigation derived waste

XX: Two-character sample type code

SB = Soil Boring

CS = Concrete

SW = Surface Wipe

SD = Sediment

WW = Wastewater

AC = ACM sample

TX = Test Pit, where X represents sample media as follows

E = Encrusted deposits

D = Sediment

S = Soil

C = Concrete

P = Product

W = Water

examples: TC = concrete sample from a test pit

TS = soil sample from a test pit

$\#\#_S$: Two-digit sample number

For all samples except soil borings:

01 = 1st sample of a given type at a given building

02 = 2nd sample of a given type at a given building

Soil Borings: $\#\#_S(\#\#_T\text{-}\#\#_B)$

$\#\#_S$ = Soil boring number

$\#\#_T$ = Top of sample depth range

$\#\#_B$ = Bottom of sample depth range

example: 02(09-10) = 2nd soil boring, 9-10 ft depth interval

MMYY: Date of sample collection

MM = month

YY = year

example: 0901 = sample collected in September 2001

QQQ: QAQC Type of sample

omitted = Investigative Sample

DQC = Contract Laboratory QC Duplicate Sample

DQA = CEWES QA Duplicate Sample

RIN = Rinsate Sample

MS = Matrix Spike Sample

MSD = Matrix Spike Duplicate Sample

Site Characterization Sample ID Examples

01SB-03(05-06)-1101	5-6 foot depth interval in the 3rd soil boring collected in Building 1 during November 2001
01SB-03(05-06)-1101RIN	Rinsate sample of equipment used to collect the above sample
SRSD-15-1101	15th sediment sample collected from the sewers in November 2001
02TC-02-1201	Concrete sample from the second test pit sampled in Building 2 in December 2001

5.3.2 Risk Assessment Samples

Although risk assessment samples and site characterization samples will be collected with the same techniques in the field, the risk assessment samples will have sample ID's which distinguish them from the site characterization samples.

Format: Identical to site characterization samples, but with an "RA-" appended to the beginning of the ID

Risk Assessment Sample ID Examples

RA-01SB-03(05-06)-1101	5-6 foot depth interval in the 3rd risk assessment soil boring collected in Building 1 during November 2001
RA-01SB-03(05-06)-1101DQC	Duplicate of the above sample

5.3.3 Trip Blank Samples

Since trip blanks packed with other samples for shipment to the laboratory are unique, they will be assigned unique sample ID's.

Format: TRB-XX##-MMDDYY

Where each element of the sample ID represents the following identifying information:

TRB: Common designation for all trip blank samples

XX: Two-character designation for the laboratory to which the samples were sent

CS = CEWES

Other laboratories to be designated upon their selection

##: Two-digit shipping container number

01 = 1st container of VOC samples sent to the laboratory on a given day

02 = 2nd container of VOC samples sent to the laboratory on a given day

MMDDYY: Date trip blank is sent to laboratory

MM = month

DD = day

YY = year

example: 110501 = November 05, 2001

Trip Blank Sample ID Examples

TRB-CS01-120201	1st trip blank sent to CEWES on December 02, 2001
TRB-LB04-112301	4th trip blank sent to a lab designated as "LB" on November 23, 2001

5.4 SAMPLE DOCUMENTATION

Sample documentation will include:

- Field logbook
- Sample collection field sheets
- Sample labels
- Chain-of-Custody (COC) forms
- Custody seals
- Receipt-for-sample form
- Cooler receipt forms

The field leader or sample manager will be responsible for reviewing the information contained in the sample collection field sheets and logbook, and the preparation of the COC forms. The field leader will also be responsible for keeping the field project file, contact with contractual and owner's analytical laboratories, and contact with equipment and field suppliers.

All original data recorded in the field logbooks and on sample labels, sample collection field sheets, and COC forms will be written in waterproof ink. If an error is made on an accountable document, corrections will be made simply by crossing out the error with one line and entering the correct information. The erroneous information will not be obliterated. Any error discovered on a document will be corrected by the person who made the entry. All corrections will be initialed and dated.

5.4.1 Sample Labels

Adhesive sample labels for the identification of each sample collected will be pre-printed and they will include the following information:

- Label heading: "URS Group, Inc., SLAAP Site-Specific EBS (49-F0K96219.01), St Louis, MO"
- Sample identification number (e.g. 01SB-03(05-06)-1101)
- Sampler initials (to be filled in at the time and date of sampling)
- Date/Time (to be filled in at the time and date of sampling)
- Sample matrix
- Chemical analysis to be performed
- Sample Container and Preservative (if any)

- Analytical laboratory

A fine point permanent marker will be used to fill the blanks on the sample labels. Labels will be protected with a coat of wide clear tape once all information is complete and before sample containers are filled. An example of labels to be used in the field is provided in **Figure 5-1**.

5.4.2 Sample Collection Field Sheets

Sample collection field sheets will be used to record all sample information including:

- Sample identification number
- Sampler(s)
- Date and time of sample collection
- Sampling methodology (e.g. hand auger) and sample type (e.g. subsurface soil), and sample matrix (e.g. soil)
- Analysis requested and sample preservation
- Approximate volume of sample collected

Sample collection field sheets will be initially placed in a plastic bag with sample containers in a chilled cooler. Sample collection field sheets will be filled out with complete information at the time of sampling. **Figure 5-2** presents an example of a sample collection field sheet.

Each sample will be documented on the sample collection field sheets, and all paperwork will be returned with the samples to the sample manager. The sample manager will log the samples in the COC forms for shipment to the laboratory for analysis.

5.4.3 Chain-of-Custody Records

Logging of the samples into the COC forms will be performed using Site Manager Pro (SMPro). SMPro is a Microsoft Windows-based data management software used to implement the sampling plan and prepare COC forms in the field. A typical COC form is presented in **Figure 5-5**.

Once the samples are logged into SMPro, a COC form will be printed out and placed into the cooler with the corresponding samples for shipment to the laboratory. A copy of the COC forms will be kept by the sample manager.

COC numbers are entered as a data field in SMPro. These numbers are generated using the following elements: year, month, day, analytical laboratory designator, and shipping piece number sequence for the day. An example of a COC number for USACE Chemistry Quality Assurance Branch of the Waterways Experiment Station Environmental Laboratory (CEWES), cooler three, shipped on November 5, 2001 will be identified as: 011105CEWES03. Analytical laboratory designators for contract laboratories will be established after the contract laboratories have been selected.

Additional information to be transferred onto the COC is as follows:

- Project name and number
- Project location
- Project manager
- Sampler's initials
- COC number
- A complete list of analyses, with specific selection of the requested analysis
- Sample date and time
- Sample type and matrix
- Number of sample containers
- Sample identification
- Sample manager signature
- Date and time of sample release to courier or shipper
- Airbill number
- Laboratory address
- Laboratory subcontract number

The temperature blank will be hand-written to the COC form. Prior to sealing the COC form in the individual sample cooler, the sample manager will sign and date the COC form, relinquishing the samples to the laboratory. The COC form will then be placed inside a plastic zip-lock type bag and the bag will be taped to the inside lid of the cooler.

5.4.4 Custody Seals

Custody seals are used to ensure that sample packages have not been opened during shipment. The following information will be included on the custody seals applied to the front and back of each cooler:

- Signature of the sample custodian
- Date when the sample package was sealed

5.4.5 Cooler Receipt Forms

A cooler receipt form (**Figure 5-6**) will be filled out by the laboratory sample custodian on each cooler received. The purpose of this form is to obtain cooler receiving conditions and sample log-in information. URS will supply these forms prior to any sampling activities. Completed cooler receipt forms will be kept with COC forms.

5.5 DOCUMENTATION PROCEDURES

Steps for documenting sample collection during the field work are as follows:

1. Enter into the field logbook the date and time, the location identification, sampling team personnel present, weather conditions, and other pertinent information regarding field activities.
2. Complete the sample collection field sheet.
3. After sample collection, lids for each sample container will be secured and samples stored with ice or frozen, reusable chemical packs in an insulated cooler to maintain sample temperature of approximately 4°C.
4. The Chemical Quality Control (CQC) Representative or his designee will fill out the COC form by recording sampling information directly from the labels on the sample containers. The sample collection field sheets will not be used to fill out the COC forms. Each sample container label will be checked for completeness.
5. When the COC form(s) and the sample collection field sheet(s) are completed, a photo copy(s) will be made and placed in the project file.
6. Sample packaging procedures are described in Section 7.1.
7. The sample container air bill will be completed with the name, address, company, and phone numbers of the sender and the recipient. The air bill will be marked for priority overnight delivery when shipments are sent on Monday through Thursday. The air bill will be marked for Saturday delivery when shipments are sent on Friday. Payment will be marked by checking the box labeled "Sender". The internal billing reference number will be placed on the air bill.
8. When the air bill is completed, a photocopy of the form will be made and placed in the project file.
9. The day after a sample shipment, the sample manager will contact the laboratory to confirm that all shipped samples have arrived and are in satisfactory condition. The last three columns of the sample tracking field sheet will be completed for the samples that were shipped the previous day.

5.6 CORRECTIONS TO DOCUMENTATION

All original data recorded in the field logbooks, sample labels, sample collection field sheets, and chain-of-custody forms will be written in waterproof ink. If an error is made on an accountable document, corrections will be made simply by crossing out the error with one line and entering the correct information. The mistaken entry will not be covered up, "whited out", or erased. Any error discovered on a document will be corrected by the person who made the entry. All corrections will be initialed and dated.

This section describes procedures for properly handling and shipping the environmental samples collected at the site. The procedures described in this section are performed after samples have been collected, placed in the proper containers and correctly preserved.

6.1 SAMPLE STORAGE

Upon collection of the samples, they will be placed in a cooler with ice and transported back to the field office by either the sampling team or the sample manager. At the field office, all individual sample containers will be placed in plastic zip-lock bags. Four 40 milliliter VOC vials (which constitutes one sample) will be placed into a zip-lock bag. An ice bath will then be prepared by placing several bags of ice in a plastic tub and then adding some water. The sample containers will then be partially submerged in the ice bath along with one temperature blank per tub of samples. Samples will remain in the ice baths until packing.

6.2 SAMPLE PACKING

All samples collected will remain in the possession of the sampling crew until shipment. Locked vehicles, buildings or trailers will be used for interim storage as necessary. If coolers used for sample storage must be left unattended for extended periods of time, signed custody seals will be placed on the coolers.

Once the COC forms are printed and signed, one copy of this document will be made. The copy will be used as a packing list for each cooler. A detailed comparison between each sample label and the entries on the COC form will be made to ensure accuracy. Any discrepancy should be corrected by following the guidelines in Section 5.6. This practice is a QC mechanism to ensure that all samples are placed in the cooler for shipment and that all paperwork is accurate.

COC records for CEWES will also have the appropriate laboratory information management system (LIMS) numbers in the remarks box on the lower right hand corner of the COC form. The LIMS number for this sampling event will be provided by CEWES.

Sample packing will begin by preparing a portable insulated container (cooler) for use as the shipping vessel. Old shipping tags, labels, and any other markings from previous shipments will be removed from the cooler. The inside of the cooler will be wiped out with a paper towel wetted with deionized water. A layer of styrofoam sheeting or bubble wrap will be placed in the bottom of the cooler to cushion the samples. A large plastic garbage bag will be used as a liner for the cooler.

VOC vials will be wrapped in packing foam or bubble wrap and then placed in a plastic zip-lock bag. Two VOC trip blank vials will be shipped in each sample cooler containing VOC samples. The trip blanks will be appropriately labeled, wrapped with one set of VOC samples, and then inserted into the same plastic bag as the set of samples. Sample containers will then be placed upright in the lined cooler in such a way that they will not touch each other during shipment. Packing material such as bubble wrap will be placed between the bottles at the discretion of the sample custodian. A 40 ml temperature blank supplied by each laboratory will be included in the cooler.

All samples will be shipped to the laboratory on ice. Ice in double-lined bags will be placed around, and on top of the sample containers. If pre-frozen blue ice is used, it will be carefully placed inside the cooler to avoid direct contact with glass ampule containers. Additional inert packing material will be placed in the cooler. The signed COC form will be placed inside a plastic zip-lock type bag and taped to the inside lid of the shipping cooler. The cooler will then be closed and taped shut with filament-type strapping tape.

At least two signed custody seals will be placed on the cooler and taped over, one on the front and one on the side. Additional seals may be used as needed. The shipping information will be affixed on the top of the cooler. The cooler will be handed over to the local courier or delivered directly to the shipper by a sampling team member.

6.3 SAMPLE SHIPPING

Sample containers will be delivered to the shipping company by a local courier or a sample team member. Air bills will be pre-typed with information regarding analytical laboratory address (destination), contact person and phone number, sender address, name and phone number, and project and task number. The type of services required from the delivery company will also be marked appropriately (i.e., next day morning delivery, weekday delivery except for Friday shipment that should be marked for SATURDAY DELIVERY).

In addition to the shipping labels, a pre-typed label will be taped on the cooler top with both the sender and receiver addresses on them. Proper warning labels will be placed on the cooler to advise shipper of the presence of breakable containers in the cooler.

6.4 LABORATORY SAMPLE RECEIVING

Upon receipt of the sample coolers at the appropriate laboratory, the laboratory will check the following items:

- The cooler will be checked for damage or leakage and custody seals will be verified to be intact
- Contents of each cooler will be compared with the COC to verify that all sample ID and requested analyses match and that no samples are missing
- Bottles will be inspected for breakage or leakage
- The temperature of the sample and the temperature blank will be measured and recorded on the COC form
- The pH of liquid samples will be measured (to verify proper pH) and recorded
- Any discrepancies between cooler contents and COC forms will be noted and/or comments provided regarding damaged samples or problems in the "remarks" section of COC form
- Cooler receipt forms (**Figure 5-6**) provided by URS will be filled out and included in the laboratory's hard copy report
- The URS Chemical QA Officer will be contacted immediately regarding problems with a sample.

Laboratory analyses of all samples will be performed by contract laboratories which have not yet been identified and the Waterways Experiment Station. Addresses and points of contact for these laboratories are provided below.

Analytical Laboratory	Analysis	Address	Contact Person	Phone Number Fax Number
CEWES	VOCs, Explosives, Metals, SVOC's, Pesticides, Inorganics	420 S. 18th Street Omaha, NE 68102	Laura Percifield Shelly Swink	(402) 444-4314 (402) 444-4318
Contract Laboratory(s) To Be Determined	VOCs, Explosives, Metals, SVOC's, Pesticides, Inorganics, ACM			

IDW generated during project activities will include decontamination (rinse) water, soil from soil borings and sediment sampling, concrete from concrete sampling, disposed debris and soils from test pit excavation, and personal protective equipment (PPE). General procedures for managing IDW are as follows:

- Decontamination fluids and fluids generated during sampling activities will be containerized in a holding tank or in 55-gallon drums. Containerized decontamination fluids will be labeled and inventoried. Labels will, at a minimum, define the contents, the date the IDW was collected, and the reason for containerization. An up-to-date container inventory will be maintained on site that documents the type of container, the contents of the container, date of arrival at storage area, and the container status (e.g., awaiting analytical results). In addition, routine visual inspections of the storage area will be made to identify areas of potential leaks or spills. At the conclusion of the field sampling activities, samples of the containerized fluids will be submitted to the analytical laboratory for analysis of PCBs, SVOCs, and total metals as discussed below.
- Unused portions of soil samples will be returned to the sampling location (i.e. placed back into the bore hole or sediment location).
- Unused portions of concrete from concrete samples and miscellaneous concrete cuttings will be placed back into the core holes from which they were collected.
- Disposed debris, soils and concrete from test pit excavations will be returned to the test pit as backfill material.
- PPE will be placed in plastic trash bags and disposed as municipal waste.

Decontamination fluids will be sampled according to the procedures outlined in Section 4.9. Final disposition of the containerized IDW will be determined based on the results of the laboratory analysis.

During field activities, Daily Chemical Quality Control Reports (DCQCRs) will be prepared daily, dated, signed by the Chemical Quality Control Representative or his designee, and sent to the URS project manager (See **Figure 8-1**). The DCQCR will include the following information:

- Weather information at the time of sampling
- Field instrument measurements
- Calibration
- Problems
- Deviations that may affect data quality objectives
- QA/QC sample tables
- Copies of COC forms

This section discusses corrective action procedures to be followed in the event that a discrepancy is discovered by field personnel, field auditors, and/or laboratory personnel. Typical discrepancies include improper sampling procedures, improper instrument calibration procedures, improper sample preservation, and problems (e.g., broken jar, missing label, etc.) with samples upon receipt at the laboratory.

The Chemical Quality Control (CQC) Representative will be responsible for the implementation of the FSP procedures. In the event of any improper sampling procedure, the CQC Representative will ask the sampling team to immediately comply with this FSP and will document the discrepancy and circumstances, and will direct the sampling team to re-collect samples (if necessary) under the proper protocol.

Instruments will be calibrated and maintained according to manufacturer recommendations. A list of the instruments required is shown in **Table 9-1**. The instrument calibration logbook will be inspected daily by the CQC Representative, or his designee. Any instrument problems will be immediately reported to the CQC Representative. It will be the responsibility of the CQC Representative to make arrangements to replace the instrument with another one in proper working condition. Improper instrument calibration and corrective action will be documented in the logbook and reported in the DCQCR.

Sample preservation procedures in the field will be supervised by the CQC Representative, or his designee. Laboratory pre-preserved containers will be inspected by the CQC Representative, or his designee. In the event that any sample container has an incorrect or insufficient amount of preservative, the sample container will be discarded and a new sample container and label will be provided by the CQC Representative, or his designee. In the event of sample container breakage or leakage in the field, new samples will be collected. Proper documentation will be completed by the CQC Representative, or his designee, to document the circumstances. This documentation will be part of the field project file.

Problems with samples after receipt at the laboratory will be addressed by the CQC Representative. In the event of discrepancies between the COC and the sample labels, corrections will be made according to procedures described in Section 5.6. If sample containers are broken or if a sample container is missing from the cooler, the laboratory will notify the CQC Representative, or his designee, who will arrange for a new sample to be collected. Proper documentation will be attached to the original sample field sheets and the original COC form to document the corrective action.

Any other deviation from Part I of this SAP will be initially reported to the CQC Representative who is responsible for reporting the details in the DCQCR.

A proposed schedule for the field sampling and report preparation activities is presented in below. Due to the anticipated start date for the field effort in early November 2001, the schedule takes into account holiday periods in November and December.

Activity/Task	Calendar Days to Complete
Field Work Preparation	Completed within 5 days from Approval of Work Plans
Field Mobilization	3 days
Field Work - Initial	25 days
Field Work – Contingency Samples	Started within 2 days of receipt of initial analytical results; completed within 14 days from receipt of analytical results for initial samples
Demobilization	3 days
Chemical Analysis Completed	14 days after laboratory receives final samples
Data Validation Completed	14 days from receipt of final analytical results
Draft Report	30 days from receipt of final analytical results
Review/Comments on Draft Report	14 days
Final Report	30 days from receipt of review comments

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Table 1-1. Summary of Physical Features for Building 1

Building Characteristics	
Building Name	Billet Cutting Building
Area	8,770 square feet (ft^2)
Style	One story
Construction Materials	Steel frame and roof truss building with corrugated asbestos siding. The floor is reinforced concrete. The roof is precast concrete slab deck with a pitch felt and gravel surface.
Construction Date	Built in 1944
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-millimeter (mm) Howitzer shell production)
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Summary	Steel billets were stored in concrete and H-beam racks outside of the eastern and western sides of Building 1. Long 4-inch square steel billets or bars were fed into the building via conveyor systems to four nicking machines (two on the east and two on the west sides). Each nicking machine consisted of eight oxygen-assisted acetylene torches that would create a nick approximately 1/4" deep and 3/16" wide along the width of each bar. Following nicking, conveyor feeds would move the billets through a direct-contact water cooling process to eight breaking machines (each rated for 530 slugs per hour). Billet ends from each end slug were cut to size in cold saw machines. Snag grinding, as necessary, was completed on all breaks that did not meet specifications. Following inspection, the finished 8-1/2" slugs were mounted on skids and transported to the forge building (Building 2).
Process Machinery	Process machinery included conveyor tables, billet nicking machines, conveyer systems equipped with water sprays, hydraulic breaking presses, cold saws and a saw sharpener, snag grinders, fume exhaust fans, a dust collector, self-propelled electric cranes, unit ventilators, pits under hydraulic breaking machines, pits with process water discharge, and a pit with an acetylene drip pot.
Process Utilities	Water, steam, compressed air, acetylene gas, oxygen gas, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Acetylene, quench water, cooling oil, hydraulic fluids, and machine lubricants.
Hazardous Material Storage and Usage Areas	Pits under hydraulic break machines, two pit with process water discharge, and a pit below the acetylene drip pot
Hazardous Material Off-Loading Areas	A loading dock is present along the northern side of the building.

Table 1-2. Summary of Physical Features for Building 2

Building Characteristics	
Building Name	Forge Building
Area	First Floor: 73,095 ft^2 Second Floor (Switching Room): 792 ft^2 Third Floor (Machine Balconies): 2,964 ft^2 Fourth Floor (Catwalks): 1,803 ft^2 Fifth Floor (Locker Rooms): 1,701 ft^2
Style	Five stories
Construction Materials	Steel frame and roof trusses on reinforced concrete piers, corrugated asbestos siding, and an asbestos-covered metal roof.
Construction Date	1944
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-mm Howitzer shell production)
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Description	The building contained 10 gas- and oil-fired rotary furnaces for slug heating and forging. Cut steel billets from Building 1 were forged into hollow cylinders. After forging, the billets were cooled by water spraying and quenching. Various hydraulic systems were also used in the production process.
Process Machinery	Rotary furnaces, piercing presses, sizing and de-scaling units, hydraulic draw benches, conveyors, accumulators, air hammers, cooling tanks, oil heaters, cranes, metal grinders, transformers, and air compressor motors and cylinders.
Process Utilities	Electricity, water, fuel oil, compressed air, steam, and natural gas.
Hazardous Material Information	
Possible Hazardous Material Used	Hydraulic and fuel oils, solvents (toluene), asbestos, LBP, quench water, and machine lubricant oils
Hazardous Material Storage and Usage Areas	First Floor: A fuel oil distribution system, hydraulic oil systems, and cooling tanks Second Floor: Two transformers and switches Outside: A 10,000-gallon regular (leaded) gasoline UST and dispenser (abandoned and filled with sand in 1959; removed in 1992)
Hazardous Material Off-Loading Areas	The UST was filled using a fill port on top of the tank. Fuel oil was off-loaded into pipes contained in loading pits. These pits were located north of Building 2 from 1944 to 1958 and east of the building from 1958 to 1969.

Table 1-3. Summary of Physical Features for Building 3

Building Characteristics	
Building Name	Machining Building (also known as Building 202ABC)
Area	Basement: 37,000 square feet (ft^2) First Floor: 168,000 ft^2 Second Floor: 154,780 ft^2 Penthouse: 6,813 ft^2
Style	Two stories, basement, and two penthouses
Construction Materials	Steel frame and roof beams on reinforced concrete piers and spread footings; masonry walls; and a prefabricated concrete roof. The eastside addition has the same structure, but also is covered with asbestos siding.
Construction Date	Built in 1941, retooled (including eastside addition) in 1944. Renovated to create office space in 1984 and 1985.
Historical Use	
Occupants/Lessees	1941 to 1944: SLOP (0.30-caliber munitions production) 1944 to 1983: SLAAP (105-millimeter (mm) Howitzer shell production) 1985 to 1996: SLAAP (AVSCOM office space)
Operational Periods	1941 to 1944: 0.30-caliber munitions production 1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production 1985 to 1996: Office space
Historical Processes	
Process Description	Processes completed in Building 3 consisted of shell shaping, heat tracing, cleaning, painting, and packaging for shipment. Metal chips and fragments produced as a result of the shell machining processes were collected on the first and second floors and disposed in the chip chute. The chip chute is an open chute along the north wall that opened to the basement in Building 3. From the basement, the metal chips were transferred to a railcar via conveyor for off-site disposal.
Process Machinery	Process machinery included lathes, drill presses, milling machines, grinders, heat-treating furnaces, wash racks, welders, shapers, shot-blasting equipment, paint spray booths, transformers, air compressors, and auxiliary equipment (dust collection devices, elevators, and conveyors).
Process Utilities	Water, steam, compressed air, soluble oil, quench oil, paint, natural gas, telephone service, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Cutting (soluble) oil, quench oil (No. 6 fuel oil), hydraulic oil, solvents (toluene), asbestos, lead-based paint, and pesticides.
Hazardous Material Storage and Usage Areas	Basement: Chip chute, 6-inch diameter quench oil lines to sludge tank, transformer vaults, quench oil pump station First Floor: Cutting oil distribution system, soluble oil and mixing room, 14 quench oil tanks, paint storage room, hydraulic oil reclaiming unit, five wash racks, five paint spray booths, paint stripping room. Second floor: Cutting oil distribution system, heat treating quench oil.
Hazardous Material Off-Loading Areas	The quench oil USTs at Building 8 had remote fill capability from railroad tracks on the northeast side of Building 3.

Table 1-4. Summary of Physical Features for Building 4

Building Characteristics	
Building Name	Air Compressor Building
Area	Basement: 2,772 ft^2 First Floor: 8,450 ft^2
Style	One story with basement on the western side
Construction Materials	Steel frame and roof beams on reinforced concrete piers and spread footings and has corrugated asbestos siding and roof.
Construction Date	1944
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-mm Howitzer shell production)
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Description	Housed air compressors used to generate compressed air for processes performed in the other SLAAP buildings.
Process Machinery	Compressor motors and cylinders, intercoolers, aftercoolers, and air receivers.
Process Utilities	Electricity, water, compressed air, and steam.
Hazardous Material Information	
Possible Hazardous Material Used	ACM, LBP, and hydraulic and motor oils
Hazardous Material Storage and Usage Areas	Two transformers
Hazardous Material Off-Loading Areas	None

Table 1-5. Summary of Physical Features for Building 5

Building Characteristics	
Building Name	Headquarters and Office Building (also known as Building 202D)
Area	Basement: 1,153 ft^2 First Floor: 11,662 ft^2 Second Floor: 10,075 ft^2 Penthouse: 392 ft^2
Style	Two stories with basement and penthouse
Construction Materials	Steel framework with reinforced concrete (brick-covered) walls and piers with spread footings. The floors are reinforced concrete. Some corrugated asbestos siding was used on certain walls. The building has a pre-cast concrete roof with insulation board underneath.
Construction Date	Built in 1941, altered in 1944 to office space. Renovated and upgraded in 1984.
Historical Use	
Occupants/Lessees	1941 to 1944: SLOP (primer building) 1944 to 1983: SLAAP (office space) 1962 to 1967: Futura Manufacturing Company (assembly of radios) 1985 to 1996: SLAAP (AVSCOM office space)
Operational Periods	1941 to 1944: Primer loading 1944 to 1945: Office space 1952 to 1954: Office space 1962 to 1967: Assembly of pocket-sized radios 1966 to 1969: Office space 1985 to 1996: Office space
Historical Processes	
Process Description	Served as a primer loading plant for 0.30-caliber ammunition from 1941 until 1944, when the machinery was removed and office space renovations were conducted. This building was also leased from 1962 to 1967 to the Futura Manufacturing Company for assembly of pocket-sized radios.
Process Machinery	Small arms ammunition loading machinery until 1944, an elevator, and steam unit heaters.
Process Utilities	Water, steam, telephone service, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Hydraulic oil, ACM, LBP, cleaners, transformer oil, primers, solvents, metals, and light ballasts
Hazardous Material Storage and Usage Areas	Transformers, light ballasts, and oil storage outside
Hazardous Material Off-Loading Areas	None

Table 1-6. Summary of Physical Features for Building 6

Building Characteristics	
Building Name	West Office and Laboratory Building (also known as Building 202E)
Area	Basement: 1,153 ft^2 First Floor: 9,825 ft^2 Second Floor: 10,477 ft^2 Penthouse: 118 ft^2
Style	Two stories with basement and penthouse
Construction Materials	Steel framework with reinforced concrete (brick-covered) walls and piers with spread footings. The floors are reinforced concrete. Some corrugated asbestos siding was used on certain walls. The building has a pre-cast concrete roof with insulation board underneath.
Construction Date	Built in 1941, altered in 1944 to office space.
Historical Use	
Occupants/Lessees	1941 to 1944: SLOP (small arms primer insert building) 1944 to 1983: SLAAP (office space and laboratory) 1985 to 1996: SLAAP (AVSCOM office space)
Operational Periods	1941 to 1944: Small arms primer insertion 1944 to 1945: Office and laboratory space 1952 to 1954: Office and laboratory space 1966 to 1969: Office and laboratory space 1985 to 1996: Office space
Historical Processes	
Process Description	Utilized for small arms primer insertion from 1941 until 1944, when the machinery was removed and office space renovations were conducted. A metallurgical laboratory occupied a small part on the first floor and performed quality control testing. Operations included polishing, measuring, and some etching.
Process Machinery	Small arms primer insertion machinery, ventilators for the laboratory, a dark room, radiators, and steam unit heaters.
Process Utilities	Water, steam, telephone service, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Small amounts of unidentified laboratory chemicals and solvents as well as hydraulic oil, ACM, LBP, cleaners, transformer oil, and light ballasts.
Hazardous Material Storage and Usage Areas	Transformers, light ballasts, and the laboratory
Hazardous Material Off-Loading Areas	None

Table 1-7. Summary of Physical Features for Buildings 7 and 7A

Building Characteristics	
Building Name	Water Pump House (Bldg. 7) and Cooling Tower (Bldg. 7A)
Area	Building 7 1,048 ft² Building 7A 635 ft²
Style	Building 7 is one story, cooling tower was 15 feet tall (demolished).
Construction Materials	Building 7 is constructed of concrete block walls, a reinforced concrete floor on a reinforced concrete slab, and a tar and gravel roof. The cooling tower is a wooden frame tower on a concrete base.
Construction Date	1944
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-mm Howitzer shell production)
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Description	Building 7 housed water pumps used to circulate process (coolant) water between Buildings 2 and 4. A cooling tower (Building 7A) was located east of Building 7.
Process Machinery	Water pumps and piping
Process Utilities	Electricity, water, compressed air, and steam.
Hazardous Material Information	
Possible Hazardous Material Used	ACM and LBP in Building 7. Hexavalent chromium associated with the cooling tower.
Hazardous Material Storage and Usage Areas	None
Hazardous Material Off-Loading Areas	None

Table 1-8. Summary of Physical Features for Buildings 8 and 8A

Building Characteristics	
Building Name	Fuel Storage Area (Bldg. 8) and Oil Pumphouse (Bldg. 8A)
Area	Building 8 1,048 ft^2 Building 8A 635 ft^2
Style	The Fuel Storage Area is a square area bounded by earthen dams on three sides and a natural slope on the fourth. The Storage Area was divided into three equal sections by walls. Building 8A is one story.
Construction Materials	Building 8 had concrete block walls and earthen dams. Building 8A has concrete block walls, a reinforced concrete slab floor, and a tar and gravel roof.
Construction Date	1944
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-mm Howitzer shell production)
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Description	From 1944 to 1969, Building 8 was used to store fuel oil used by the rotary furnaces and other process machinery in Building 2. The fuel was pumped into Building 2 from storage tanks in Building 8 utilizing pumps located in Building 8A. (Note: From 1944 to 1958, Building 8 was located north of Building 2. In 1958, Building 8 was relocated to the east side of Building 2 in order to make way for Interstate 70 construction.) The storage tanks were removed and donated to the Missouri Department of Transportation in 1986.
Process Machinery	ASTs, piping, oil pumps, and oil heaters
Process Utilities	Electricity, water, foamite fire retardant, fuel oil, compressed air, and steam.
Hazardous Material Information	
Possible Hazardous Material Used	Fuel oil in Building 8. Fuel oil, ACM, LBP in Building 8A.
Hazardous Material Storage and Usage Areas	Fuel oil stored in nine 16,000- to 19,000-gallon ASTs and an oil drain sump used to temporarily store "dirty" return oil from Building 8A oil pumps
Hazardous Material Off-Loading Areas	From 1944 to 1958, oil was off-loaded from trucks into pipes in two loading pits located south of Building 8 at the top of the natural slope. The exact location of Building 8 from 1958 to 1969 is not known, but it was likely located east of Building 2.

Table 1-9. Summary of Physical Features for Buildings 9A through 9D

Building Characteristics	
Building Name	Acetylene Generation Area
Area	Building 9: 1,228 ft^2 Building 9A: 2,061 ft^2 Building 9B: 378 ft^2 Building 9C: Not applicable Building 9D: 455 ft^2
Style	Building 9: Single story Building 9A: Single story Building 9B: Sludge pit Building 9C: AST Building 9D: Single story
Construction Materials	Building 9: Wooden frame, rafters, and roof; tile walls; and a concrete floor Building 9A: Concrete walls and floor; wooden rafters and decking Building 9B: Reinforced concrete Building 9C: Steel with reinforced concrete supports Building 9D: Concrete walls and floor, wooden rafters and roof decking
Construction Date	Built in 1941 and modified in 1944. Acetylene Generator Building, Sludge Pits, and Oxygen Receiver removed in early 1980s.
Historical Use	
Occupants/Lessees	1944 to 1983: SLAAP (105-mm Howitzer shell production)
Operational Periods	1941 to 1944: Smokeless powder storage and canning 1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production
Historical Processes	
Process Description	The Acetylene Generation Area supported acetylene production for SLAAP. Acetylene was generated by mixing calcium carbide and water. The reaction was contained in four acetylene generators in Building 9. Acetylene was then distributed through underground piping to Buildings 2 and 3. The byproduct of this reaction, calcium hydroxide slurry, was stored in two sludge pits located in Building 9 until it was transported off site.
Process Machinery	Acetylene generators, pumps, a cold oxygen converter, and piping.
Process Utilities	Acetylene, water, compressed air, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Smokeless powder, calcium carbide, machining cooling oil, sludges, ACM, and LBP
Hazardous Material Storage and Usage Areas	Building 9: Smokeless powder drip pots under acetylene generators Building 9A: Storehouse for calcium carbide Building 9B: Sludge pits with a sewer outfall Building 9C: AST for oxygen Building 9D: Cold oxygen converter
Hazardous Material Off-Loading Areas	Sludges were pumped into trucks through a piping system installed on the north side of the Sludge Pits. The Sludge Pits were connected to the sewer system by underground piping.

Table 1-10. Summary of Physical Features for Building 10

Building Characteristics	
Building Name	Quench Oil Storage Tanks
Area	Building 10 consisted of three cylindrical, steel USTs and one rectangular, concrete UST. These tanks were located at the east outside end of Building 3 and were aligned in a north-south direction. The area covered by the USTs is approximately 30 by 100 feet. The tanks had the following dimensions: Tank No. / Dimensions / Capacity (gallons) 87 / 10 feet by 24 feet / 14,100 17 / 10.5 feet by 23.5 feet / 15,222 15 / 10.5 feet by 23.75 feet / 15,332 Sludge pit / 11 feet (W) x 18 feet (L) x 13 feet (D) / 17,000
Style	The USTs were horizontal steel tanks, each lying on three 18-inch-high saddles resting on a reinforced, 12-inch-thick, concrete foundation. A 7/8-inch-diameter rod with a turnbuckle was installed on each saddle for fastening the tank to the concrete foundation. The quench oil sludge pit was a reinforced concrete structure.
Construction Materials	Steel and concrete (see above)
Construction Date	1944
Historical Use	
Occupants/Lessees	1941 to 1944: SLOP 1944 to 1983: SLAAP 1985 to 1996: AVSCOM
Operational Periods	1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production 1993: UST removal activities were initiated in Jan 93.
Historical Processes	
Process Description	The three quench oil USTs and the sludge pit supplied cooling oil (No. 6 fuel oil) to 14 quench oil tanks on the first floor of the east section of Building 3.
Process Machinery	Quench oil USTs and a sludge pit.
Process Utilities	Electricity, lubricating oils, compressed air, steam, and water.
Hazardous Material Information	
Possible Hazardous Material Used	Quench oil, hydraulic oil, solvents (toluene), and heavy metals
Hazardous Material Storage and Usage Areas	Underground: The quench oil USTs were connected to 4" supply and return lines from the quench oil pumping room in Building 3. Spills drained to the quench oil sludge pit through a 6"gravity line. A second 6" gravity line was connected to the 14 indoor quench oil tank drain lines. The sludge pit clear oil return pumping system is located next to the middle section of the east basement wall of Building 3. First Floor: Transfer pumps and tanks stored quench oil. Second Floor: 14 hardening furnaces used quench oil as cooling media. Roof: 14 evaporative cooling systems cooled quench oil before it was returned to the quench oil system.
Hazardous Material Off-Loading Areas	The quench oil USTs were filled using fill ports on top of the tanks. The quench oil system had a remote 4" fill line capability from railroad tracks on the northeast side of Building 3.

Table 1-11. Summary of Physical Features for Buildings 11, 11A, and 11B

Building Characteristics	
Building Name	Foamite Generator Building (Bldg. 11) and Hose Cart Shelters (A and B)
Area	Original building covered 274 ft^2; current building has approximately same dimensions and incorporates one of the hose cart shelters. Buildings 11A and 11B are each approximately 98 ft^2.
Style	Each of the buildings is one story.
Construction Materials	The original Building 11 had concrete block walls resting on a reinforced concrete foundation (including a 2- by 3-foot concrete drain pit) and a wooden roof. The building had a glass window with a steel frame and hinged top sections to allow air ventilation. The existing building is similar to the original one except that the building also houses the foamite hose cart shelter. Each of the hose cart shelters consist of concrete block walls resting on reinforced concrete foundation walls, a wooden roof, and a reinforced concrete floor.
Construction Date	Each of the buildings was constructed in 1944. The current building was built in late 1957 and early 1958.
Historical Use	
Occupants/Lessees	1941 to 1958: SLAAP 1958 to 1983: SLAAP 1985 to 1996: AVSCOM
Operational Periods	1944 to 1945*: 105-mm Howitzer shell production 1952 to 1954*: 105-mm Howitzer shell production 1958: Building was demolished during the relocation of Building 8; a new Building 11 constructed west of Building 2 across the roadway 1966 to 1969*: 105-mm Howitzer shell production *May have been operational for fire prevention during shut-down periods
Historical Processes	
Process Description	Generation of foamite involved the addition of dry foamite powder to pressurized water through an education system. The original system included a 15-horsepower pump system, a foamite generator, and a 4" foamite line that left the south corner of Building 11 and split into two main lines. The first line ran parallel to the northeast side of Building 2, and included two hydrants located south and west of Building 8A. The second line ran along the outer northwest and northeast banks of the earthen dike. This line contained two hydrants, one north of oil tank 24 and one east of oil tank 20. Additionally, independent lines (3") were connected to each oil tank to address localized oil tank fires.
Process Machinery	Foamite generator, a 15-horsepower motor and pump with switch disconnect, foamite distribution line, flexible hoses, and hose carts.
Process Utilities	Water, the foamite line, steam, electricity, and a sewer drain.
Hazardous Material Information	
Possible Hazardous Material Used	None
Hazardous Material Storage and Usage Areas	None
Hazardous Material Off-Loading Areas	None

Table 1-12. Summary of Comprehensive Environmental Baseline Survey Results

Location	Areas of Environmental Concern	Recommendations
Sitewide	ACM	Manage ACM in accordance with Asbestos Hazard Emergency Response Act (AHERA) regulations or requirements
	LBP	Complete LBP assessments and handle accordingly
	Fluorescent light ballast potentially containing PCBs	Remove and dispose of ballasts
Building 1	PCB oil-containing electrical equipment	Remove equipment
	PCB oil stain	Decontaminate stained area
	Metal-contaminated soil in east storage area and near sewer connections	Assess extent of metal contamination and evaluate remediation alternatives
Building 2	Metal-contaminated surface soil	Characterize and remove soil
	Metal-contaminated sump water	Characterize and remove water
	Chlorinated solvents-contaminated groundwater	Extent of contamination was assessed through interpretation of results from groundwater monitoring wells and no further characterization appears warranted
	Potential PCB contamination at former hydraulic oil storage tank area	Evaluate if additional characterization is warranted
Building 3	PCB-contaminated concrete floor in basement	Evaluate and implement appropriate remediation
	PCB-contaminated soil at basement earthen soil	Characterize and remove
	PCB-contaminated concrete and brick walls in basement and first-floor chip chute areas	Evaluate and implement appropriate remediation
	Various equipment in basement	Characterize and remove materials and equipment
	Airborne pesticides detected in basement	Evaluate and implement appropriate remediation
	Cracked and peeling paint and cracked concrete floor	Evaluate in conjunction with future use of property
	Semivolatile organic compound (SVOC) and PCB-contaminated soil underneath north loading dock	Assess and remediate soil
	PCB-contaminated drain and sump water	Characterize and remove water
	PCB-contaminated elevator equipment and oil stains in penthouses	Decontaminate or remove equipment or stains
Building 4	PCB oil-containing electrical equipment	Remove equipment
	PCB oil stain under electrical equipment	Decontaminate stained area
	PCB oil-stained transformer pad	Decontaminate stained area
	PCB-contaminated material in air compressor pits	Characterize and remove material
	SVOC-contaminated soil	SVOC contamination appears to be background condition and no further characterization appears warranted

Location	Areas of Environmental Concern	Recommendations
Building 5	PCB-contaminated elevator equipment and oil stains in penthouse	Decontaminate or remove equipment and stains
	SVOC-contaminated soil	SVOC contamination may be associated with former SLOP oil storage building
Building 6	Metal-contaminated ash in hearth	Characterize and remove ash
	SVOC-contaminated soil	SVOC contamination may be associated with former SLOP oil storage building
Building 7	No areas of environmental concern	No further characterization appears warranted
Building 8 and 8A	SVOC contaminated soil with extent assessed	Extent of SVOC contamination assessed and no further characterization appears warranted
Buildings 9 and 9a through 9D	No areas of concern	No further characterization appears warranted
Building 10	Leaking UST incident extent assessed	No further characterization appears warranted; MDNR to provide guidance to close UST
Building 11, 11A, and 11B	No areas of concern	No further characterization appears warranted

Table 3-1. Identification of Inputs to the Decision

Location	Area of Environmental Concern	Sampling Method(s) and Rationale
Site-Wide	Asbestos Containing Material	No site-wide sampling of ACM is proposed. The presence of ACM throughout the site is documented in the Comprehensive EBS. Approaches to removal of ACM are well understood and readily available. These materials will be handled, as necessary, in accordance with Asbestos Hazard Emergency Response Act (AHERA) regulations.
	Lead-Based Paint	No site-wide sampling of LBP is proposed. Process knowledge and construction techniques suggest that LBP is present within and around each of the buildings at the site. Approaches to removal of LBP are well understood and readily available. These materials will be handled, as necessary, in accordance with appropriate regulations.
	Fluorescent light ballast potentially containing PCBs	No site-wide sampling is proposed. Light ballasts can be removed, as appropriate, and handled in a compliant manner without collection of additional data during this effort.
	Sewer system. The EBS report identifies concerns at several buildings with regard to potential releases to the sewer system. Given these concerns, and the site-wide existence of said system, the sewers have been added as a site-wide category.	Video surveys of the sewer system will be conducted throughout selected sewer mains as indicated on **Figure 3-10**. Sediment and wastewater samples will be collected from sewer mains via manholes (see **Figure 10** for sample locations). Contingency borings will be installed and sampled to delineate the lateral extent of contamination in the event breaches in the sewers are identified during the video survey and associated sediment/wastewater samples exceed threshold values for total metals (23), VOCs, SVOCs, PCBs, and/or TPH.
	Groundwater	Groundwater across the site consists of localized perched units that are at least 12 feet below ground surface. Detections to date have been low-level. Given the industrial setting of the site and the lack of a completed pathway, i.e., no receptors, additional groundwater characterization is not required. Consequently, no additional monitoring wells are planned as part of this effort.
Building 1	PCB oil-containing electrical equipment	No sampling of the equipment for PCBs is proposed. Samples can be collected, if required, during equipment removal, as appropriate.
	PCB oil stain	A soil boring will be installed at the stain location as shown in **Figure 3-1**. Samples will be collected from the concrete (01CS-01) and from the soils beneath the concrete floor (01SB-07). Additionally, process knowledge suggests that releases could have occurred from the breaking operations and/or leaking transformers. The integrity of the concrete floor and sump structures is unknown. Accordingly, soil borings will be advanced at two breaking locations (see **Figure 3-1**, 01SB-01 and 01SB-02) to evaluate whether or not PCB/TPH contamination exists beneath the building floor. Contingency borings will be completed if target thresholds are exceeded, to delineate the lateral extent of contamination.
	Metal-contaminated soil in east storage area and near sewer connections	Process knowledge suggests that releases containing heavy metals could have occurred to soils and the sumps/sewer system as a result of billet storage. As shown in **Figure 3-1**, soil borings will be sampled at each of the sump locations (near the cold saw cut operations and near the grinding operations, 01SB-08 through 01SB-11). Contingency borings will be completed if target thresholds are exceeded. Evaluation of the sewer system will be conducted as part of the site-wide sewer study (see site-wide section above). Soil borings will also be completed along the eastern and western sides of the building (01SB-03 through 01SB-06) and in the east and west parking lot (see **Figure 3-2**, locations 01SB-12 through 01SB-17). Contingency borings will be completed if target thresholds are exceeded, to delineate the lateral extent of contamination.

Note: All sampling and surveying activities will be completed in accordance with protocols presented in Section 4 of this FSP.

Location	Area of Environmental Concern	Sampling Method(s) and Rationale
Building 2	Metal-contaminated surface soil Metal-contaminated sump water Chlorinated solvents-contaminated groundwater Potential PCB contamination at former hydraulic oil storage tank area TPH within and under the fuel lines/vaults (regulatory concern mentioned during finalization of the Comprehensive EBS)	Process knowledge suggests that the rotary furnaces, quenching operations, maintenance area, and/or fuel delivery systems may have been responsible for environmental impacts throughout the building footprint. Building-wide contamination includes TAL/TCL metals, VOCs, PCBs, and/or TPH in surface soils, subsurface soils, and/or groundwater. Accordingly, rather than present sampling activities that directly correlate to specific areas of concern from the Comprehensive EBS, the sampling strategy for Building 2 is presented from a building-wide perspective. Investigations planned for Building 2 (see **Figure 3-3** for sample locations) are as follows: • Quench tanks within Building 2 overflowed on a regular basis to a series of north/south trending floor drains along the eastern and western perimeter of the building. These drains are believed to connect into sewer lines along the interior of the western and southern sides of Building 2. Sediment and water samples will be collected from each of the interior manholes (**Figure 3-3**, 02SD-01 through 02SD-03 and 02WW-01 through 02WW-03, respectively) in accordance with protocols presented in Section 4 of this FSP. Evaluation of the sewer system (i.e., those portions of the sewer drain system outside of the building's footprint will be conducted as part of the site-wide sewer study). • The foundation rings for each of the rotary furnaces and accompanying "production loop" (i.e., process area including descaling station, piercing operations, draw bench area, etc.) are potential collection areas for hydraulic oil, lubricants, and/or fuel. The structural integrity of these structures is unknown. Accordingly, two of the "production loops" will be excavated to determine the likelihood and degree of contamination present within and/or from these units. Sample locations (see **Figure 3-3**) 02TX-01 through 02TX-04 delineate samples to be collected from the first production loop. Sample locations 02TX-05 through 02TX-08 delineate samples to be collected from the second production loop. Suspicious sediments or residues within the structures will be sampled, if encountered. A ram-hoe attachment or equivalent equipment will be utilized to break through the concrete to allow sampling of the underlying material. Soil samples will be collected from the excavation at each of the "production loop stations". Contingency soil borings will be completed if target thresholds are exceeded. A total of 20 refractory bricks (2 from each of the 10 foundation rings) will be collected from the foundation rings for asbestos analysis (to ascertain waste disposal requirements for the bricks). Refractory brick sample locations are shown in **Figure 3-3** by sample locations 02AC-01 through 02AC-20. • Oil stains are present in various locations within the building. Surface and subsurface soil samples will be collected for PCB and TPH analysis at locations 02SB-01 through 02SB-04. Contingency samples will be collected to define lateral/vertical extent, if appropriate, pending evaluation of the initial results, to delineate the lateral extent of contamination. • An east-west trending pipe trench exists within Building 2 that served as a redundant feed system between large pumps in the building. Additionally, two large above-ground storage tanks (one on each side of the building) stored hydraulic oil that was ultimately delivered to the production loops. Soil borings will be installed along the redundant feed system and at each of the above-ground storage tank locations as indicated in **Figure 3-3** (02SB-05 through 02SB-09). Samples collected from each of the borings will be analyzed for PCBs. • Sediment samples will be collected from the fuel distribution vaults for TPH analysis. Sediment sample locations are shown on **Figure 3-3** as 08SD-01 and 08SD-02.
Building 3	PCBs in the following areas • concrete floor in basement • basement earthen soil • concrete and brick walls in basement and first-floor chip chute areas • various equipment • drain and sump water • elevator equipment and stains in penthouses	PCB contamination associated with Building 3 is being characterized and remediated under a separate effort. No additional sampling for PCBs will be conducted as part of this effort.
	Cracked and peeling paint and cracked concrete floor	Lead-based paint is addressed as a site-wide issue above.

Note: All sampling and surveying activities will be completed in accordance with protocols presented in Section 4 of this FSP.

Location	Area of Environmental Concern	Sampling Method(s) and Rationale
Building 3 (continued)	Semi-volatile organic compound (SVOC) and PCB-contaminated soil near the chip chute area on the north side of the building	PCB-contaminated soil in excess of 50 ppm is suspected to be present outside (north) of the former chip chute area. AMCOM plans to excavate and dispose of this contamination in the near future. The limits of excavation associated with this effort will be determined within the upcoming weeks. Upon determination of the excavation limits, boring locations will be identified to determine the lateral and vertical extent of any remaining contamination. It is anticipated that borings will be placed around the perimeter of the remediated region to determine the lateral extent of contamination and within the remediated region to determine the vertical extent of contamination. Additional contingency borings will be installed, if appropriate, pending results of the new borings, to delineate the lateral extent of contamination.
	Airborne pesticides in earthen soil detected in basement	Process knowledge suggests that rodent/insect controls may have been utilized in the basement. Furthermore, soils samples collected in an earlier study and an air sample collected during the EBS confirmed the presence of pesticides in the basement. Consequently, soil samples collected in support of the risk assessment will be analyzed for pesticides.
Building 4	PCB oil-containing electrical equipment	No sampling of the equipment for PCBs is proposed. Samples can be collected, if required, during equipment removal, as appropriate.
	PCB oil stain under electrical equipment	PCBs have been detected in oil stains on the concrete floor. Consequently, samples will be collected from the concrete and the underlying soils to determine the extent of the contamination (see **Figure 3-6**, 04CS-01 and 04SB-01). Contingency borings will be installed, if necessary, to delineate the lateral extent of contamination.
	PCB oil-stained transformer pads	Wipe samples will be collected in the basement beneath two large transformer bases (one external [04SW-01] and one internal [04SW-02] to the original building footprint as shown in **Figure 3-6**) and analyzed for PCBs. If PCBs are detected in excess of the PCB Rule [40 CFR 761], samples will be collected from the concrete and the underlying soils to evaluate the extent of the contamination. Contingency borings will be installed, if necessary, to delineate the lateral extent of contamination.
	PCB-contaminated material in air compressor pits	Process knowledge suggests that releases could have occurred from leaking compressors. The integrity of the concrete floor and pit structures is unknown. Accordingly, soil borings will be advanced at two locations (04SB-02 and 04SB-03) to determine whether or not PCB/TPH contamination exists within the concrete and/or beneath the building floor. Contingency borings will be completed if target thresholds are exceeded. Sample locations are shown on **Figure 3-6**.
	SVOC-contaminated soil	The Comprehensive EBS Report states that SVOC contamination is likely a background condition and no further characterization is warranted.
Building 5	PCB-contaminated elevator equipment and oil stains in penthouse	PCBs have been detected in oil staining near the elevator equipment in the penthouse. Oil staining has also been visually observed in the elevator shaft. Consequently, a wipe sample (05SW-01) will be collected from stained area within the elevator shaft. Samples of the concrete and the underlying soils will be collected if the wipe sample indicates that PCBs are present. Contingency borings will be installed, if necessary, to delineate the lateral extent of contamination. Sample locations are shown on **Figure 3-7**.
	SVOC-contaminated soil	One soil boring (05SB-01) will be installed at the former oil storage area and sampled for SVOC and TPH. Contingency borings will be installed, if necessary, to delineate the vertical extent of contamination. Sample locations are shown on **Figure 3-7**.
Building 6	Metal-contaminated ash in hearth	The detection of metal contamination in the hearth ash created a concern with regard to the old ventilation system. In an earlier building configuration, the dark room and laboratory were adjacent to the hearth room and were all likely tied into the same ventilation ducting. Renovation activities would have generally eliminated any contaminants that may have been present. However, to address the concern with regard to the old ventilation system, a wipe sample (06SW-01) and a sediment sample (06SD-01) will be collected from the ventilation ducting in the hearth room and analyzed for metals, VOCs, and SVOCs. Sample locations are shown on **Figure 3-8**.
	SVOC-contaminated soil	One soil boring (06SB-01) will be installed at the former oil storage area and sampled for SVOC and TPH. Contingency borings will be installed, if necessary, to delineate the vertical extent of contamination. Sample locations are shown on **Figure 3-8**.

Note: All sampling and surveying activities will be completed in accordance with protocols presented in Section 4 of this FSP.

Location	Area of Environmental Concern	Sampling Method(s) and Rationale
Building 7	EBS identified no areas of environmental concern, however, concrete staining in the building and hexavalent chromium from the cooling tower operations will be addressed as part of this FSP.	TPH is suspected in stains on the building floor. Consequently, a wipe sample (07SW-01) will be collected from the stained area and analyzed for TPH. Samples of the concrete and the underlying soils will be collected if the wipe sample indicates that TPH is present. Contingency borings will be installed, if necessary, to delineate the lateral extent of contamination. Sample locations are shown on **Figure 3-9**. Process knowledge suggests that sediments from the cooling tower operation may contain hexavalent chromium. Consequently, a test pit (07TX-01) will be excavated within the former cooling tower base to identify whether the sediment layer exists. A soil sample will be collected from the sediment layer and analyzed for hexavalent chromium. If the analytical results exceed threshold values, a trench will be excavated laterally from the test pit to establish the radial extent of contamination. Samples will be collected at 10 foot intervals at discrete depth locations from within the trench. Sample locations are shown on **Figure 3-9**.
Building 8 and 8A	SVOC-contaminated soil with extent assessed. Regulatory comments on the EBS Report requested additional characterization of the fuel lines leading to Building 2.	Extent of SVOC contamination has been assessed as part of the Comprehensive EBS and no further characterization appears warranted. As noted in the Building 2 description above, sediment samples (08SD-01 and 08SD-02) will be collected from within the fuel distribution vaults for TPH analysis. Contingency borings will be installed, if necessary, to delineate the lateral extent of contamination. Additionally, soil borings (08SB-01 through 08SB-07 will be installed along the fuel distribution pipeline connecting Buildings 2 and 8. Sample locations are shown on **Figure 3-3**.
Buildings 9 and 9A through 9D	No areas of concern	No futher characterization appears warranted.
Building 10	Leaking UST incident extent assessed	Soil borings will be installed at locations outside of the original excavation to determine the levels of residual contamination associated with the USTs. Soil samples will be analyzed for TPH and BTEX. Sample locations are depicted in **Figure ??**.
Building 11, 11A, and 11B	No areas of concern	No futher characterization appears warranted.

Note: All sampling and surveying activities will be completed in accordance with protocols presented in Section 4 of this FSP.

Table 3-2. Summary of Sample Collection Activities

Area of Concern/ Figure Numbers	Phase	Wipe	Concrete	Soil Boring	Test Pit	Sediment	Wastewater	ACM
Site-Wide	Primary					11	11	
Figure 3-10	Contingency							
Building 1	Primary		1	17				
Figures 3-1 and 3-2	Contingency			54				
Figure 3-11	Risk			10				
Building 2	Primary			9	8	2	2	20
Figure 3-3	Contingency			64				
Figure 3-11	Risk			12				
Building 3	Primary		To be determined					
To Be Developed	Contingency							
Figure 3-11	Risk			18				
Building 4	Primary	2	1	3				
Figure 3-6	Contingency		2	14				
Figure 3-11	Risk			10				
Building 5	Primary	1		1				
Figure 3-7	Contingency		1	5				
Figure 3-11	Risk			16				
Building 6	Primary	1		1		1		
Figure 3-8	Contingency			4				
Figure 3-11	Risk			16				
Building 7	Primary	1			1			
Figure 3-9	Contingency		1	1	6			
Figure 3-11	Risk			16				
Building 8	Primary			7		2		
Figure 3-3	Contingency			32				
Figure 3-11	Risk			20				
Building 10	Primary		To be determined					
To Be Developed	Contingency							
Figure 3-11	Risk							
Totals	Primary	5	2	38	9	16	13	20
	Contingency	0	4	174	6	0	0	0
	Risk	0	0	118	0	0	0	0

Table 9-1. Required Field Instruments

Instrument	Intended Use
Water Quality Monitor	Collection of water quality parameters for wastewater samples
PID	Detection of organic vapors in confined spaces
Multi-Gas Meter	Measurement of O_2 and explosive gasses in confined spaces
Dust Monitor	Quantification of dust levels during concrete cutting and coring operations

FIGURE 5-6

COOLER RECEIPT FORM

LIMS #: ____________________

Contractor Cooler: ____________________
QA Lab Cooler No.: ____________________
Number of Coolers: ____________________

PROJECT: ____ **Date Received:** ____________________

USE OTHER SIDE OF THIS FORM TO NOTE DETAILS CONCERNING CHECK-IN PROBLEMS.

A. PRELIMINARY EXAMINATION PHASE: Date cooler was opened: ____________________

by (print) ____________________ (sign) ____________________

1. Did cooler come with a shipping slip (air bill, etc.)? .... YES NO

   If YES, enter carrier name and air bill number here: ____________________

2. Were custody seals on outside of cooler? .... YES NO

   How many and where: ____________________, seal date: __________, seal name ____________________

3. Were custody seals unbroken and intact at the date and time of arrival? .... YES NO
4. Did you screen samples for radioactivity using the Geiger Counter .... YES NO
5. Were custody papers sealed in a plastic bag and taped inside to the lid? .... YES NO
6. Were custody papers filled out properly (ink, signed, etc.)? .... YES NO
7. Did you sign custody papers in the appropriate place? .... YES NO
8. Was project identifiable from custody papers? If YES, enter project name at the top of this form. .... YES NO
9. If required, was enough ice used? .... YES NO

   Type of Ice: ____________________

10. Have designated person initial here to acknowledge receipt of cooler: ____________________ (date) ____________________

B. LOG-IN PHASE: Date samples were logged-in: ____________________

by (print) ____________________ (sign) ____________________

11. Describe type of packing in cooler: ____________________
12. Were all bottles sealed in separate plastic bags? .... YES NO
13. Did all bottles arrive unbroken and were labels in good condition? .... YES NO
14. Were all bottle labels complete (ID, date, time, signature, preservative, etc.)? .... YES NO
15. Did all bottle labels agree with custody papers? .... YES NO
16. Were correct containers used for the tests indicated? .... YES NO
17. Were correct preservatives added to samples? .... YES NO
18. Was a sufficient amount of sample sent for tests indicated? .... YES NO
19. Were bubbles absent in VOA samples? If NO, list by CAS: ____________________ YES NO
20. Was the project manager called and status discussed? If YES, give details on the back of this form .... YES NO
21. Who was called? ____________________ By whom? ____________________ (Date) ____________________

FIGURE 8-1

DAILY FIELD REPORT

Client: USACE Contract No.: DACW41-96-D-8014, Task Order 0019 Date: ________ Report No.: ________

Description and Type of Work: ________

Sky: ________ Temp (min/max): ____/____ Precip: ________ Wind (speed/direction): ____/____ Humidity: ____

Contractor/Subcontractors and Area of Responsibility
a.
b.
c.
d.
e.
f.
g.

1. Work Performed Today: Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in table above.

Time	Activity

2. Results of Surveillance: Include satisfactory work completed, or deficiencies with action to be taken.

3. Tests performed and results of tests (per contract documents)

4. Remarks: Cover instructions or conflicts in plans and specifications

5. Time and materials furnished by URS (Itemized report attached for other staff and expenses)

Total Hours Worked ____________ Special Charges ____________

Mileage ____________

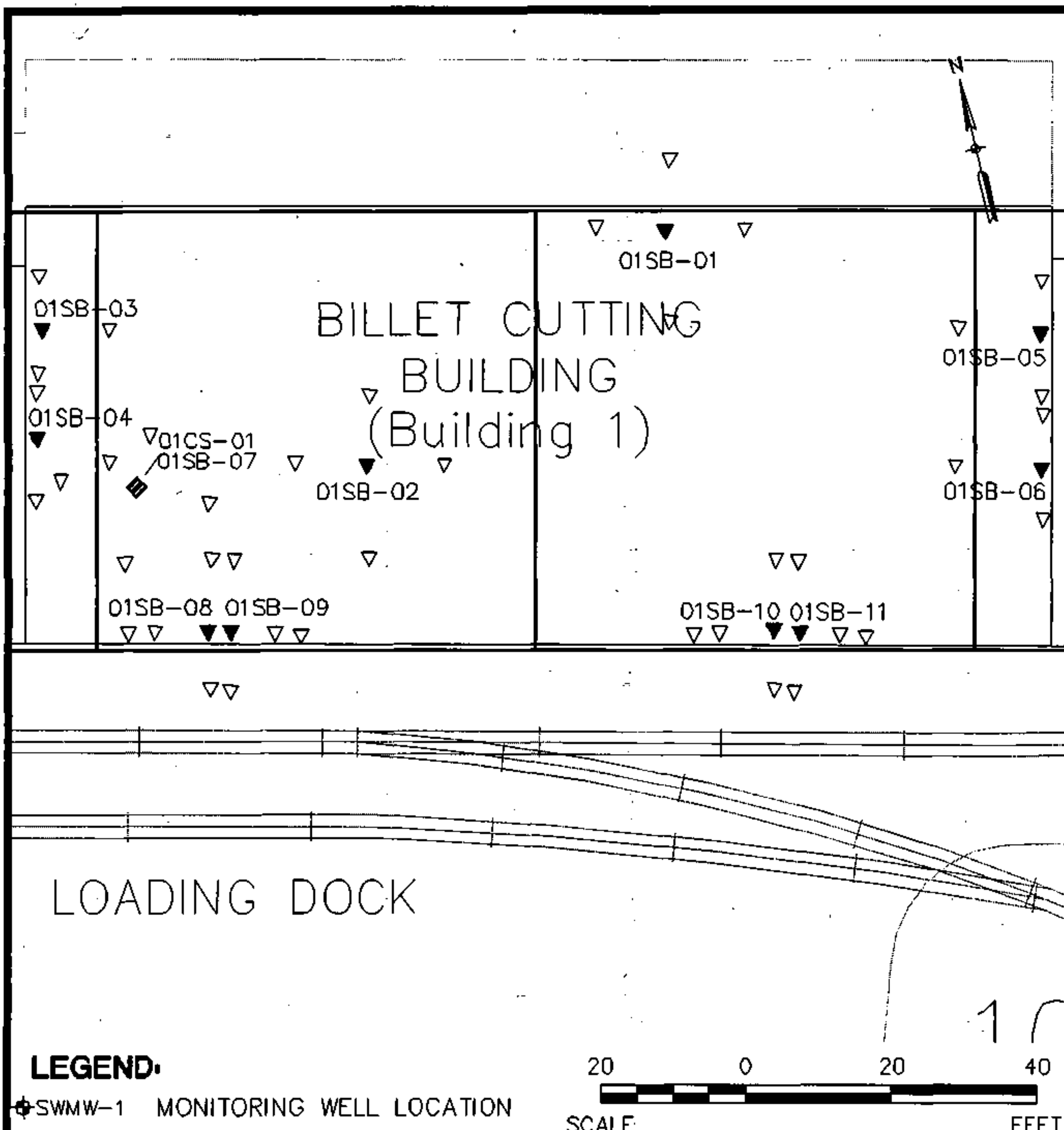
Expenses ____________

Prepared by: ____________

Owners Verification: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract documents except as noted above.

Report Period ____________

____________ Date: ____________
Owner's Authorized Representative



LEGEND:

- SWMW-1 MONITORING WELL LOCATION
- ■07TX-01 TEST PIT (□ = CONTINGENCY BORING)
- ▼01SB-04 SOIL BORING (▽= CONTINGENCY BORING)
- ▲04SW-02 SURFACE WIPE SAMPLE

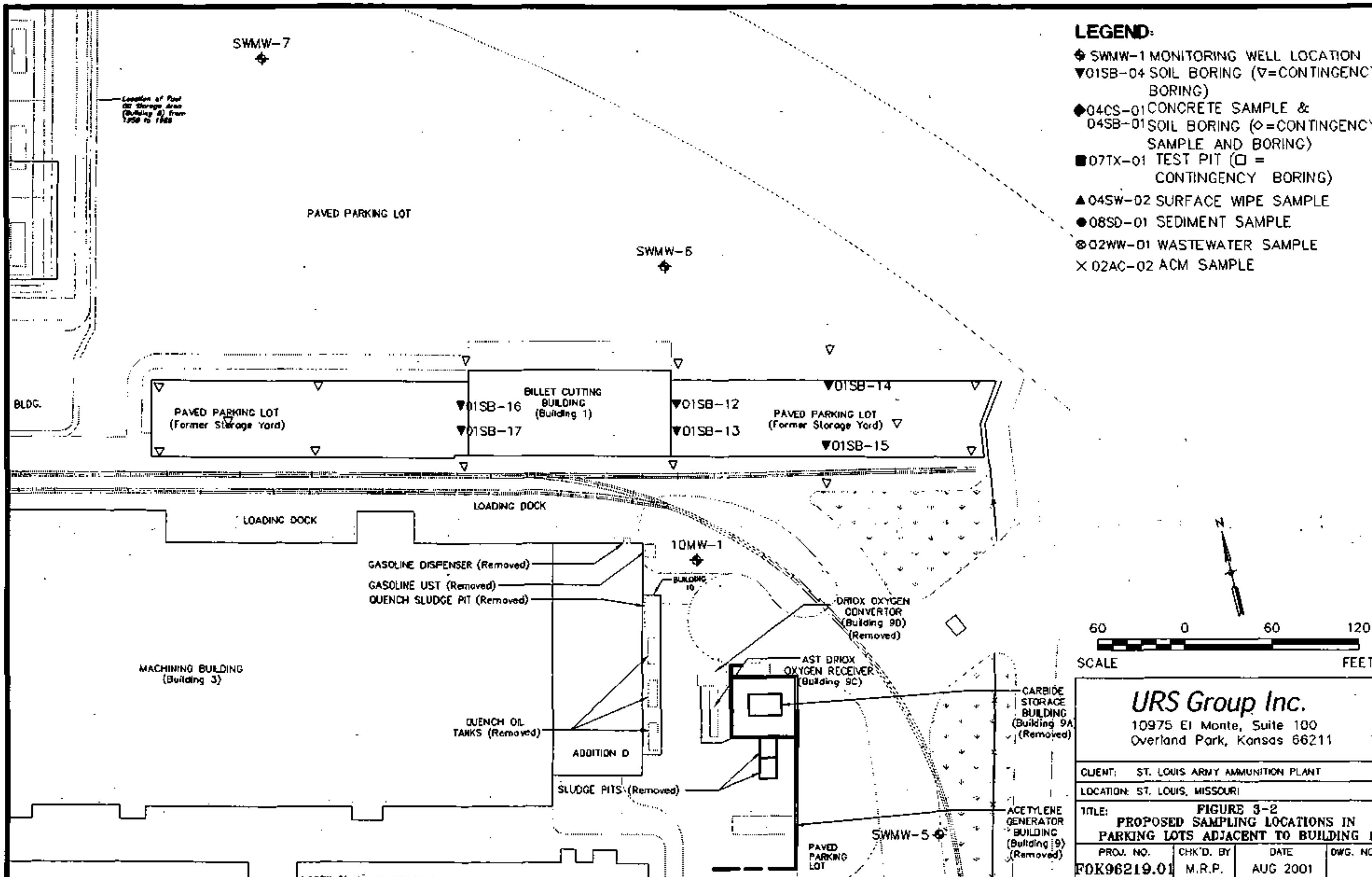
URS Group Inc.
10975 El Monte, Suite 100
Overland Park, Kansas 66211

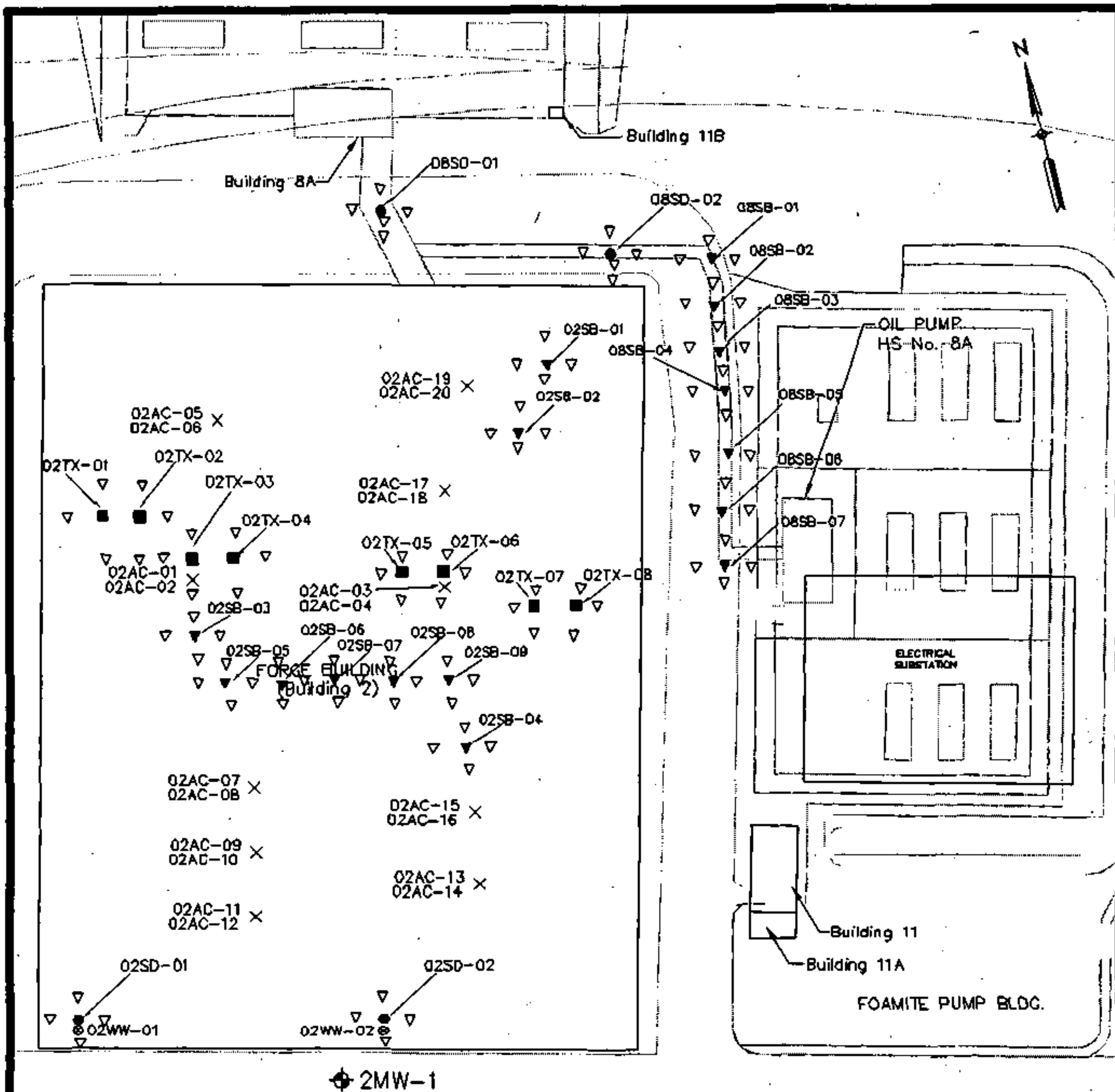
CLIENT: ST. LOUIS ARMY AMMUNITION PLANT

LOCATION: ST. LOUIS, MISSOURI

TITLE: **FIGURE 3-1 PROPOSED SAMPLING LOCATIONS IN BUILDING 1**

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	


LEGEND:
SWMW-1 MONITORING WELL LOCATION
01SB-04 SOIL BORING (▽=CONTINGENCY BORING)
04CS-01 CONCRETE SAMPLE &
04SB-01 SOIL BORING (◇=CONTINGENCY SAMPLE AND BORING)
07TX-01 TEST PIT (□ = CONTINGENCY BORING)
04SW-02 SURFACE WIPE SAMPLE
08SD-01 SEDIMENT SAMPLE
02WW-01 WASTEWATER SAMPLE
02AC-02 ACM SAMPLE
SWMW-7
PAVED PARKING LOT
SWMW-6
BLDG.
PAVED PARKING LOT (Former Storage Yard)
01SB-16
01SB-17
BILLET CUTTING BUILDING (Building 1)
01SB-12
01SB-13
01SB-14
PAVED PARKING LOT (Former Storage Yard)
01SB-15
LOADING DOCK
LOADING DOCK
10MW-1
GASOLINE DISPENSER (Removed)
GASOLINE UST (Removed)
QUENCH SLUDGE PIT (Removed)
BUILDING 10
DRIOX OXYGEN CONVERTOR (Building 9D) (Removed)
MACHINING BUILDING (Building 3)
AST DRIOX OXYGEN RECEIVER (Building 9C)
QUENCH OIL TANKS (Removed)
ADDITION D
CARBIDE STORAGE BUILDING (Building 9A) (Removed)
SLUDGE PITS (Removed)
ACETYLENE GENERATOR BUILDING (Building 9) (Removed)
SWMW-5
PAVED PARKING LOT
N
60 0 60 120
SCALE FEET
URS Group Inc.
10975 El Monte, Suite 100
Overland Park, Kansas 66211
CLIENT: ST. LOUIS ARMY AMMUNITION PLANT
LOCATION: ST. LOUIS, MISSOURI
TITLE: FIGURE 3-2
PROPOSED SAMPLING LOCATIONS IN PARKING LOTS ADJACENT TO BUILDING 1
PROJ. NO. F0K96219.01
CHK'D. BY M.R.P.
DATE AUG 2001
DWG. NO.



60 0 60 120

SCALE FEET

LEGEND

- SWMW-1 MONITORING WELL LOCATION
- ▼01SB-04 SOIL BORING (▽ = CONTINGENCY BORING)
- ◆04CS-01 04SB-01 CONCRETE SAMPLE & SOIL BORING (◇ = CONTINGENCY SAMPLE AND BORING)
- ■07TX-01 TEST PIT (□ = CONTINGENCY BORING)
- ▲04SW-02 SURFACE WIPE SAMPLE
- ●08SD-01 SEDIMENT SAMPLE
- ⊗02WW-01 WASTEWATER SAMPLE
- × 02AC-02 ACM SAMPLE

URS Group Inc.
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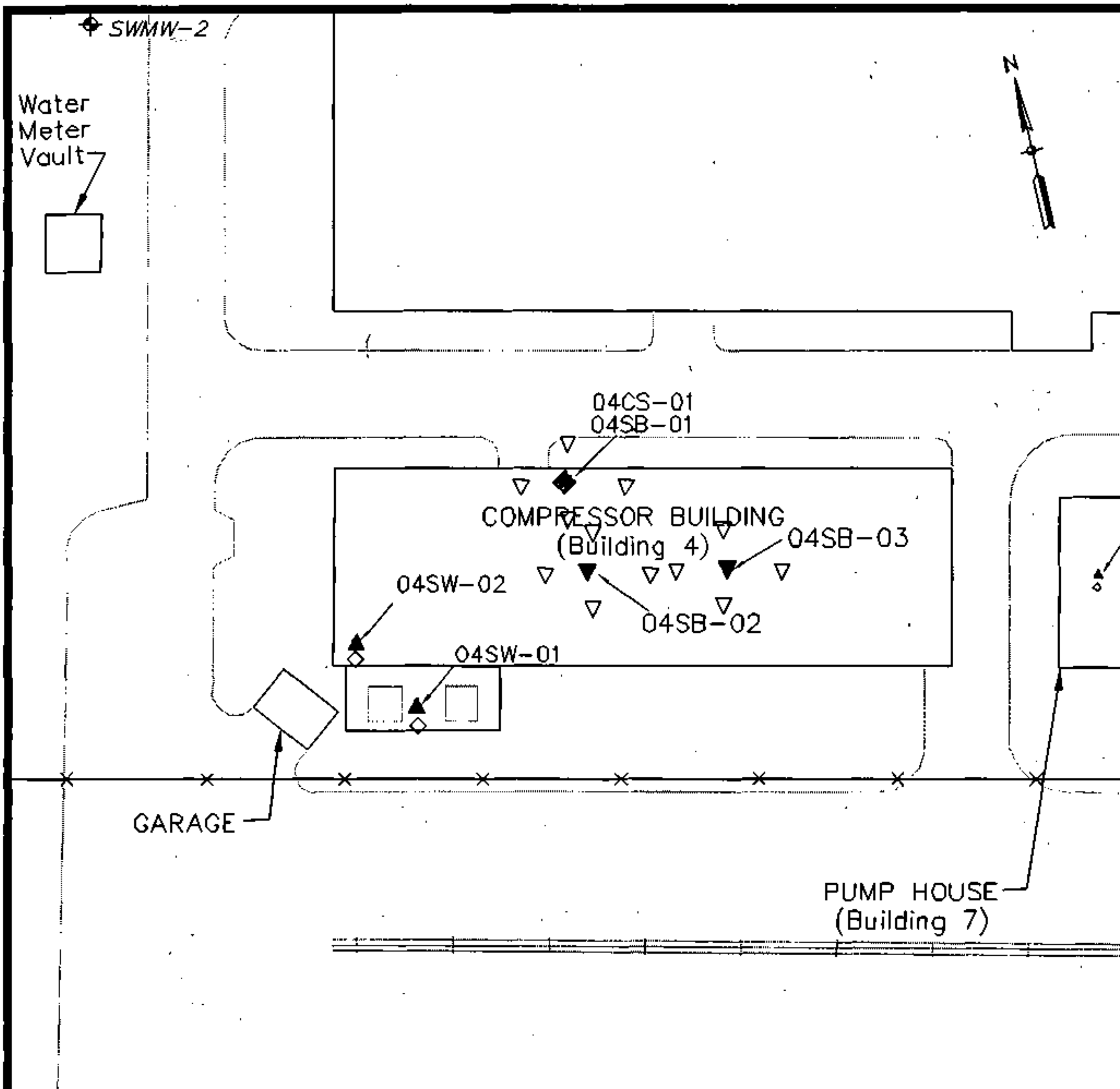
Overland Park, Kansas 66211

CLIENT: ST. LOUIS ARMY AMMUNITION PLANT

LOCATION: ST. LOUIS, MISSOURI

TITLE: **FIGURE 3-3 PROPOSED SAMPLING LOCATIONS IN BUILDINGS 2, 8 AND 8A**

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	



40 0 40 80

SCALE FEET

LEGEND:

- ⌖SWMW-1 MONITORING WELL LOCATION
- ▼01SB-04 SOIL BORING (▽ = CONTINGENCY BORING)
- ▲04SW-02 SURFACE WIPE SAMPLE
- ◆04CS-01 04SB-01 CONCRETE SAMPLE & SOIL BORING (◇ = CONTINGENCY SAMPLE AND BORING)
- ●08SD-01 SEDIMENT SAMPLE

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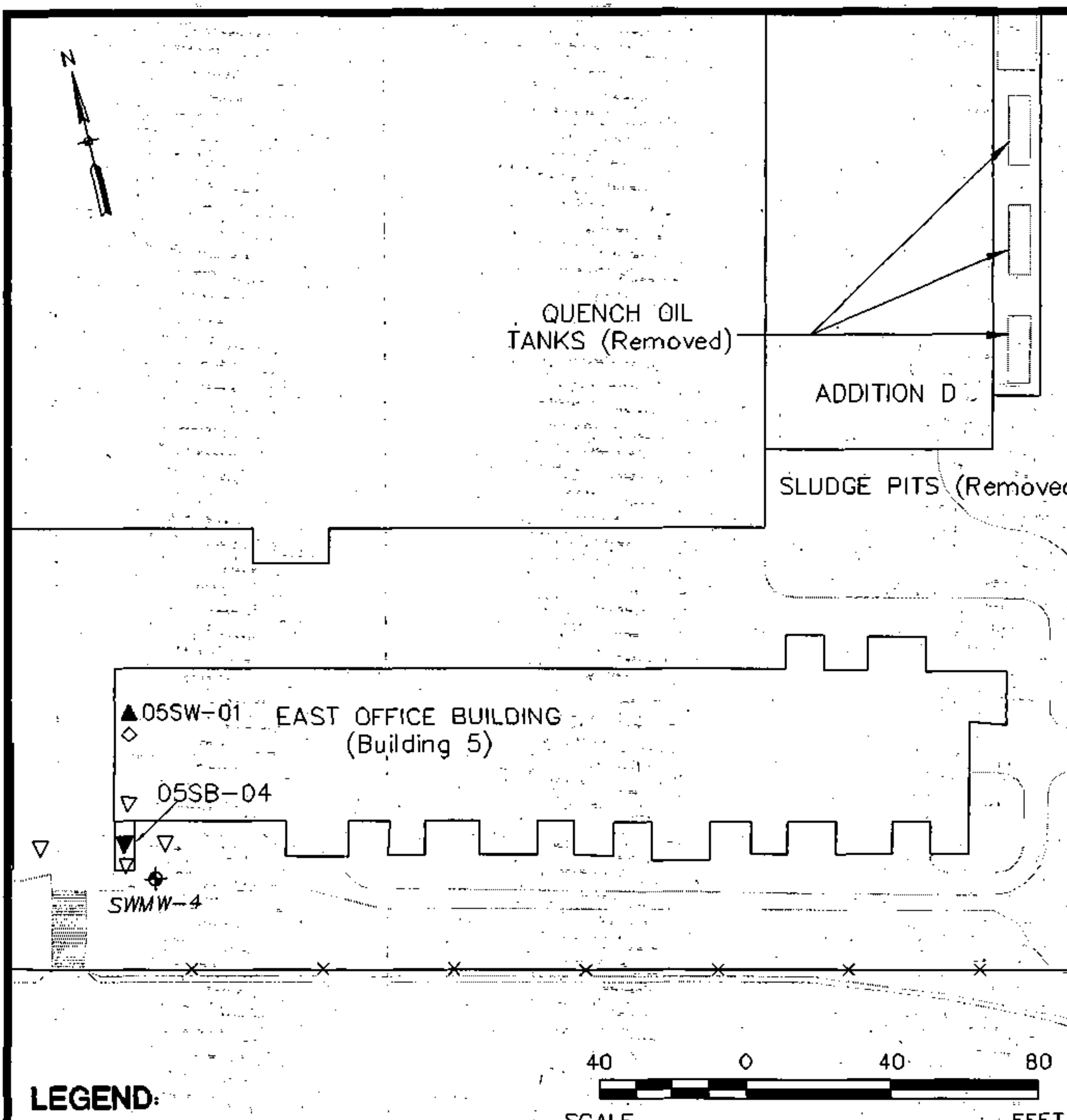
Overland Park, Kansas 66211

CLIENT: ST. LOUIS ARMY AMMUNITION PLANT

LOCATION: ST. LOUIS, MISSOURI

TITLE: **FIGURE 3-6 PROPOSED SAMPLING LOCATIONS IN BUILDING 4**

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	



LEGEND:

- SWMW-1 MONITORING WELL LOCATION
- 01SB-04 SOIL BORING (▽ = CONTINGENCY BORING)
- 04SW-02 SURFACE WIPE SAMPLE
- 04CS-01 04SB-01 CONCRETE SAMPLE & SOIL BORING (◇=CONTINGENCY SAMPLE AND BORING)
- 08SD-01 SEDIMENT SAMPLE

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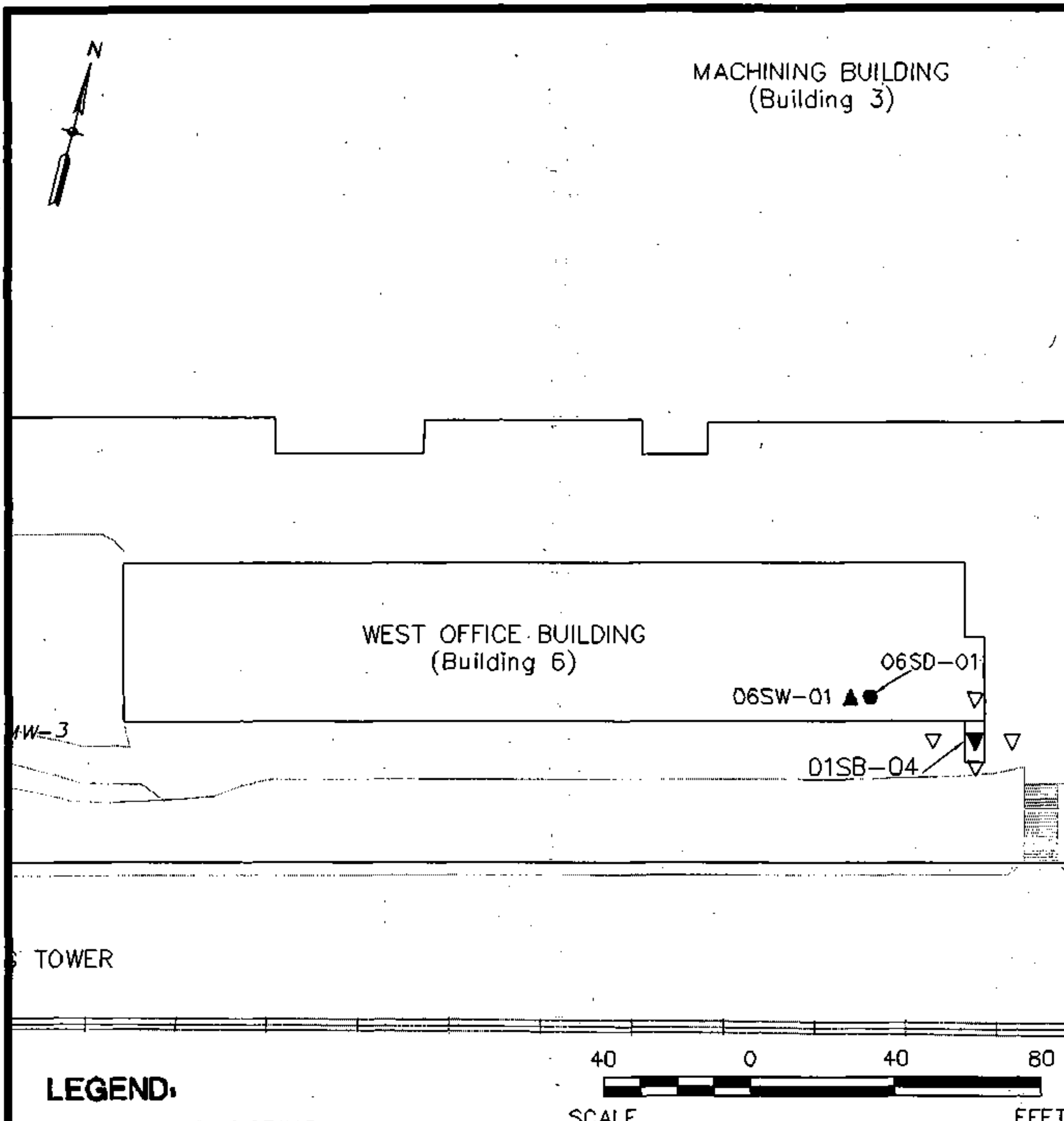
10975 El Monte, Suite 100
Overland Park, Kansas 66211

CLIENT: ST. LOUIS ARMY AMMUNITION PLANT

LOCATION: ST. LOUIS, MISSOURI

TITLE: FIGURE 3-7
PROPOSED SAMPLING LOCATIONS
IN BUILDING 5

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
FOK96219.01	M.R.P.	AUG 2001	



LEGEND:

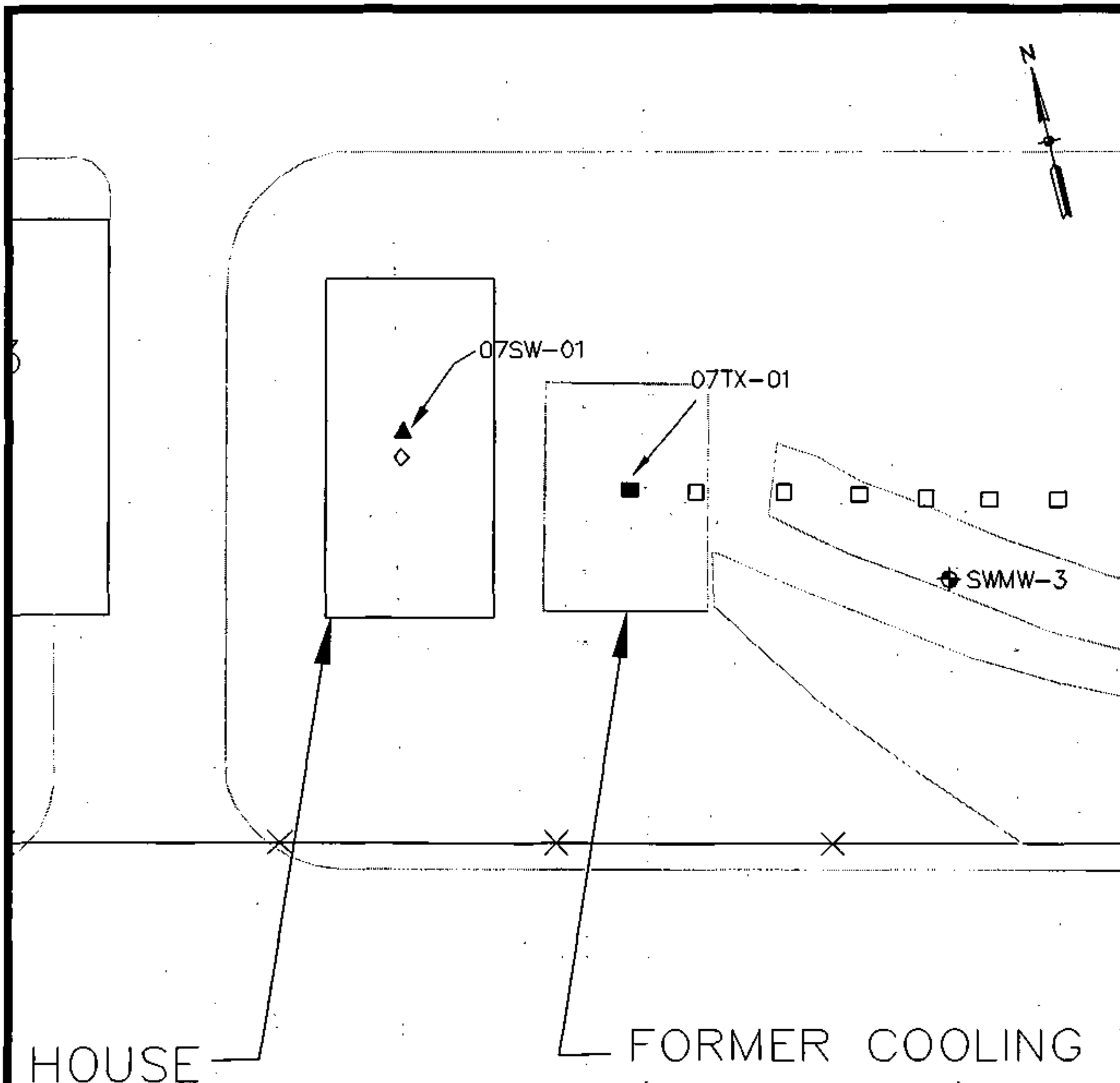
- ◆SWMW-1 MONITORING WELL LOCATION
- ▼01SB-04 SOIL BORING (▽ = CONTINGENCY BORING)
- ▲04SW-02 SURFACE WIPE SAMPLE
- ◆04CS-01 04SB-01 CONCRETE SAMPLE & SOIL BORING (◇ = CONTINGENCY SAMPLE AND BORING)
- ●08SD-01 SEDIMENT SAMPLE

URS Group Inc.
10975 El Monte, Suite 100
Overland Park, Kansas 66211

CLIENT:	ST. LOUIS ARMY AMMUNITION PLANT
LOCATION:	ST. LOUIS, MISSOURI
TITLE:	**FIGURE 3-8 PROPOSED SAMPLING LOCATIONS IN BUILDING 6**

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	

July 27, 2000 12:55:14 pm (WKS)



20 0 20 40

SCALE FEET

LEGEND:

- SWMW-1 MONITORING WELL LOCATION
- 07TX-01 TEST PIT (□ = CONTINGENCY BORING)
- ▼01SB-04 SOIL BORING (▽= CONTINGENCY BORING)
- ▲04SW-02 SURFACE WIPE SAMPLE

URS Group Inc.

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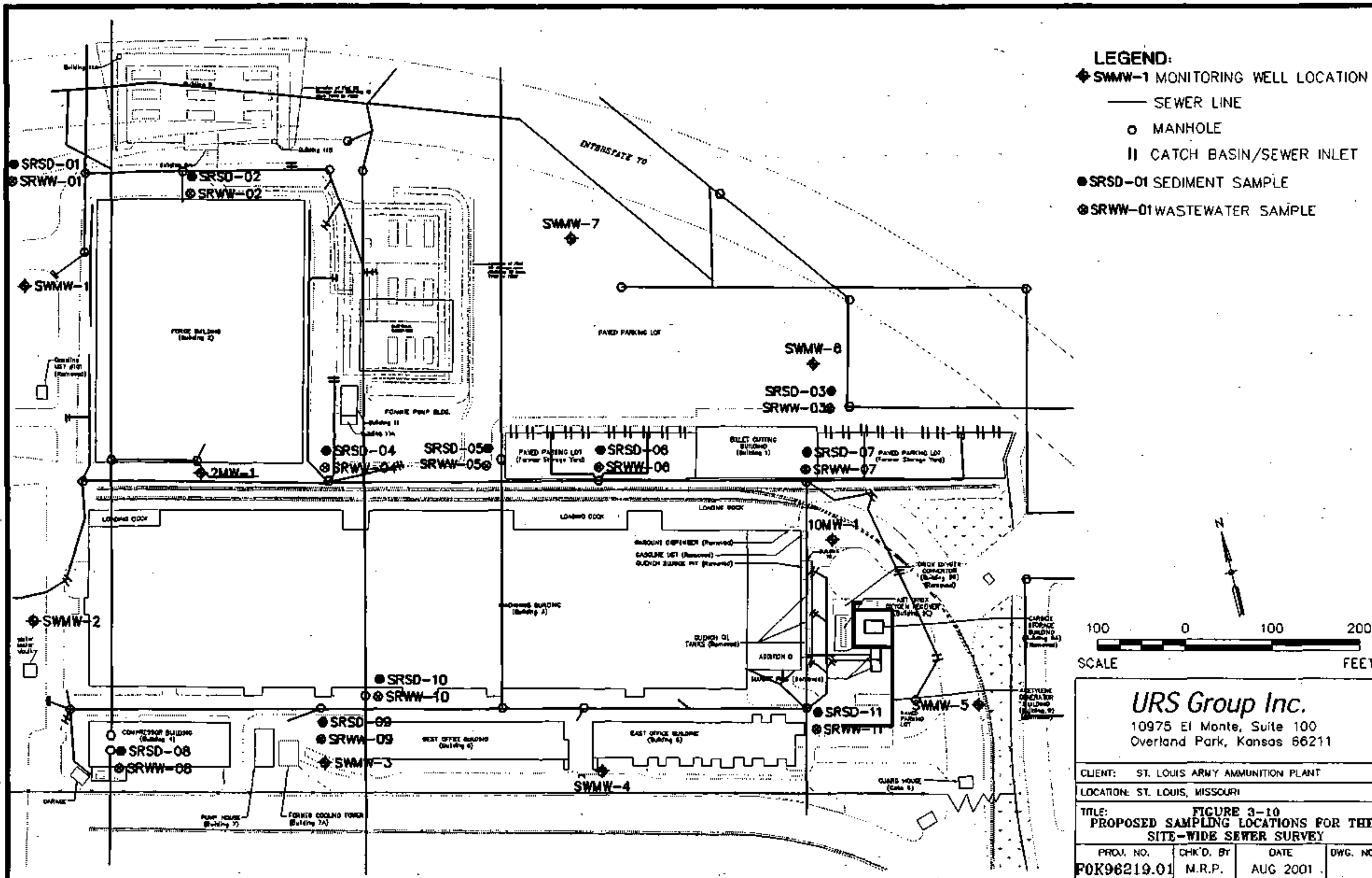
Overland Park, Kansas 66211

CLIENT: ST. LOUIS ARMY AMMUNITION PLANT			
LOCATION: ST. LOUIS, MISSOURI			
TITLE: FIGURE 3-9 PROPOSED SAMPLING LOCATIONS IN BUILDING 7			
PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	



URS Group Inc.
10975 El Monte, Suite 100
Overland Park, Kansas 66211

CLIENT: ST. LOUIS ARMY AMMUNITION PLANT
LOCATION: ST. LOUIS, MISSOURI
TITLE: FIGURE 3-10
PROPOSED SAMPLING LOCATIONS FOR THE SITE-WIDE SEWER SURVEY

PROJ. NO.	CHK'D. BY	DATE	DWG. NO.
F0K96219.01	M.R.P.	AUG 2001	

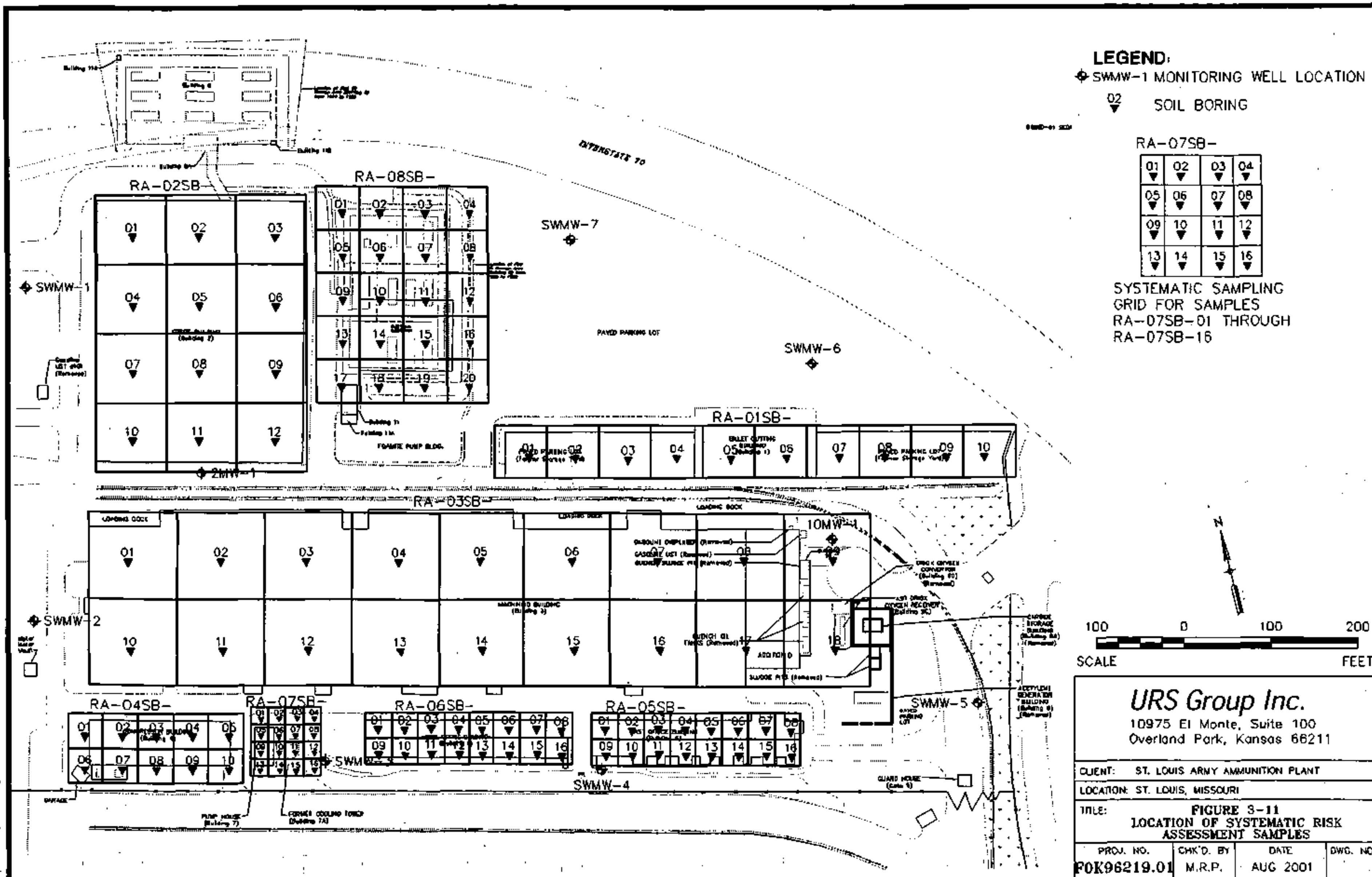

LEGEND:
SWMW-1 MONITORING WELL LOCATION
02 SOIL BORING
RA-07SB-
SYSTEMATIC SAMPLING GRID FOR SAMPLES RA-07SB-01 THROUGH RA-07SB-16
RA-01SB-
RA-02SB-
RA-03SB-
RA-04SB-
RA-05SB-
RA-06SB-
RA-07SB-
RA-08SB-
SWMW-1
SWMW-2
SWMW-3
SWMW-4
SWMW-5
SWMW-6
SWMW-7
2MW-1
10MW-1
INTERSTATE 70
PAVED PARKING LOT
100 0 100 200
SCALE FEET
N
URS Group Inc.
10975 El Monte, Suite 100
Overland Park, Kansas 66211
CLIENT: ST. LOUIS ARMY AMMUNITION PLANT
LOCATION: ST. LOUIS, MISSOURI
TITLE: FIGURE 3-11
LOCATION OF SYSTEMATIC RISK ASSESSMENT SAMPLES
PROJ. NO. F0K96219.01
CHK'D. BY M.R.P.
DATE AUG 2001
DWG. NO.

FIGURE 5-4

VISUAL CLASSIFICATION OF SOILS

[PRO]JECT NUMBER:	PROJECT NAME:	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE OF

DEPTH ( )	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	WELL CONSTRUCTION	REMARKS

NOTES:

Drilling Contractor ____________________

Drilling Equipment ____________________

[Dr]iller: ____________________

Test Pit Dimensions – Plan View (If Applicable):

COC No. 011105CEWES01

Chain of Custody Record

Project Name SLAAP Site-Specific EBS	Project No. 49-F0K96219.01	01) VOC 02) SVOC 03) PCB 04) Pesticides 05) Metals
Project Location St. Louis, Missouri	Project Manager Bob Skach	**Analytical Parameters**
Sampler(s)		

Sample Date and Time	Type: Comp.	Type: Grab	Sample Identification (Field ID)	Matrix	No. of containers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Remarks
11/5/2001 13:25:			01SB-01(00-01)-1101DQA	SOIL	2					X																
11/5/2001 14:40:			01SB-02(09-10)-1101DQA	SOIL	2			X																		
11/5/2001 16:15:			01SB-07(05-06)-1101DQA	SOIL	4			X		X																

Signatures	Date and Time	Shipping Details	Special Instructions
Relinquished by:		Method of Shipment: Federal Express	
Received by:		Airbill No. 1122334455667788	
Relinquished by:		Lab Addresses:	
Received for Laboratory by:		CEWES-CQA Branch Lab 420 S. 18th Street Omaha, NE 68102	

FIGURE 5-5

FIGURE 5-1

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-01(00-01)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-01 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-01(00-01)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-01 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-01(00-01)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-01 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR PCB
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-01(00-01)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-01 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR PCB
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-02(09-10)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-02 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-02(09-10)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-02 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-02(09-10)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-02 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR PCB
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-02(09-10)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-02 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR PCB
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-07(05-06)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-07 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

URS Group Inc.
SLAAP Site-Specific EBS (49-F0K96219.01), St. Louis, MO

Sample #: 01SB-07(05-06)-1101DQ *Sampler:* ____
Site: BLDG 1 *Date:* ____
Location: SB-07 *Time:* ____
Matrix: SOIL *Methods:*
Container: 250 ML GLASS JAR METALS
Preservative: Cool
Lab: CEWES

FIGURE 5-2

URS Group, Inc.

10975 El Monte, Suite 100
Overland Park, Kansas 66211
(913) 344-1000

SAMPLE COLLECTION FIELD SHEET

Project Name: SLAAP Site-Specific EBS

Project Number: 49F0K96219.01

Sample Number: 01SB-01(05-06)-1101

Personnel: ______

Location: BLDG 1 / SB-01

QA/QC Sample (Circle One): Yes No

Sample Media: SUBSURFACE SOIL

Method: SOIL BORING (GEOPROBE)

Collection Date/Time: YR: ______ MO: ______ DAY: ______ Time: ______

Analyte	Method (Lab Name)	Sample Container	Preservation
Field ID: 01SB-01(05-06)-1101	*QAQC Type: none*		
TPH	SW846-8015B (UNKNOWN)	1-4 oz soil jar	Cool
PCB	SW846-8082 (UNKNOWN)	1-4 oz soil jar	Cool
METALS	SW846-6010B (UNKNOWN)	1-4 oz soil jar	Cool
Field ID: 01SB-01(05-06)-1101DQA	*QAQC Type: DUP-QA*		
TPH	SW846-8015B (CEWES)	1-4 oz soil jar	Cool
PCB	SW846-8082 (CEWES)	1-4 oz soil jar	Cool
METALS	SW846-6010B (CEWES)	1-4 oz soil jar	Cool
Field ID: 01SB-01(05-06)-1101DQC	*QAQC Type: DUP-QC*		
TPH	SW846-8015B (UNKNOWN)	1-4 oz soil jar	Cool
PCB	SW846-8082 (UNKNOWN)	1-4 oz soil jar	Cool
METALS	SW846-6010B (UNKNOWN)	1-4 oz soil jar	Cool

WATER SAMPLE FIELD ANALYSIS

Temperature (C): ______ pH: ______

Conductivity (umhos/cm): ______

Salinity (parts per thousand): ______

Appearance: ______

Odor (Circle One): None Weak Strong

Preserved Sample pH: ______

pH buffer (Before): ______ (After): ______

SOIL SAMPLE OBSERVATIONS

Depth Description

COMMENTS/SKETCH

FIGURE 5-3

HTW DRILLING LOG

HOLE NO.

1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET OF SHEETS
3. PROJECT	4. LOCATION	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED	
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED	11. DATE COMPLETED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE REC. %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	1						1
	2						2
	3						3
	4						4
	5						5

PROJECT: HOLE NO.:

HTW DRILLING LOG

HOLE NO.

PROJECT	INSPECTOR	SHEET OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h

PROJECT: HOLE NO.: